THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

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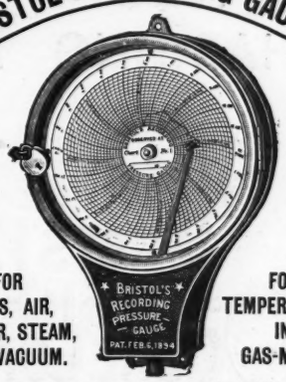

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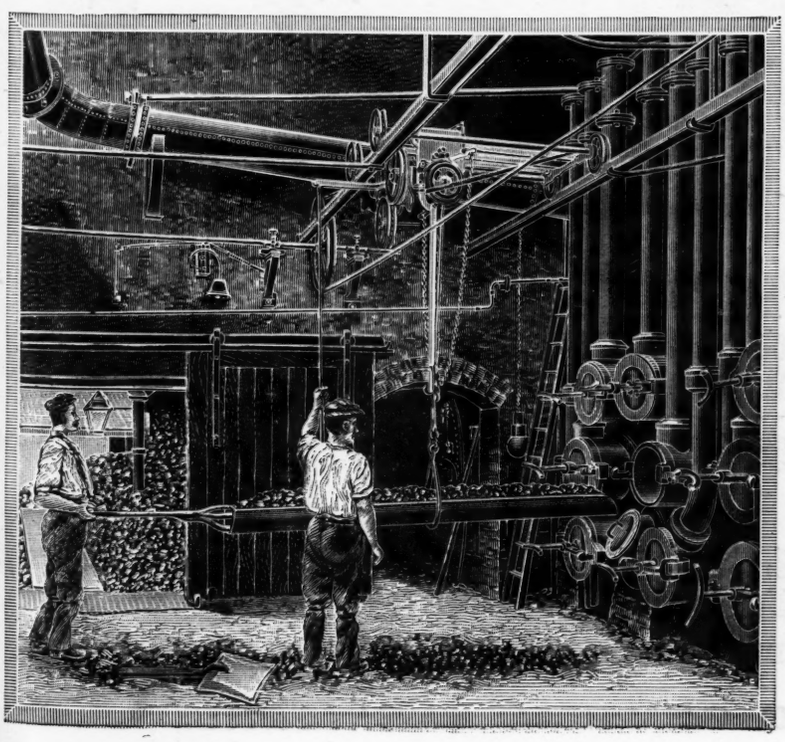

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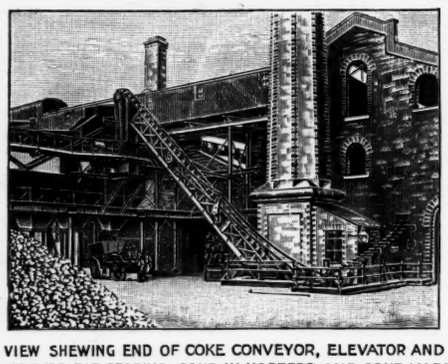
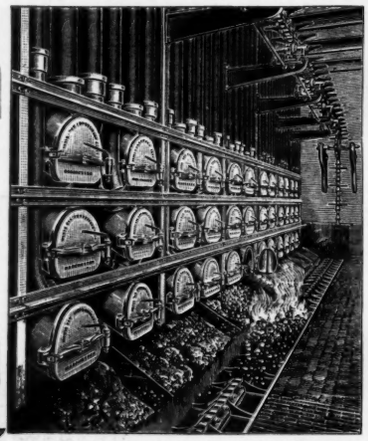
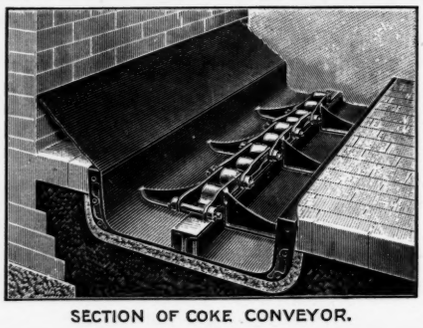


VIEW SHEWING END OF COKE CONVEYOR, ELEVATOR AND CONVEYOR FOR STORING COKE IN HOPPERS AND COKE YARD.



INTERIOR OF RETORT HOUSE SHEWING COKE CONVEYOR.



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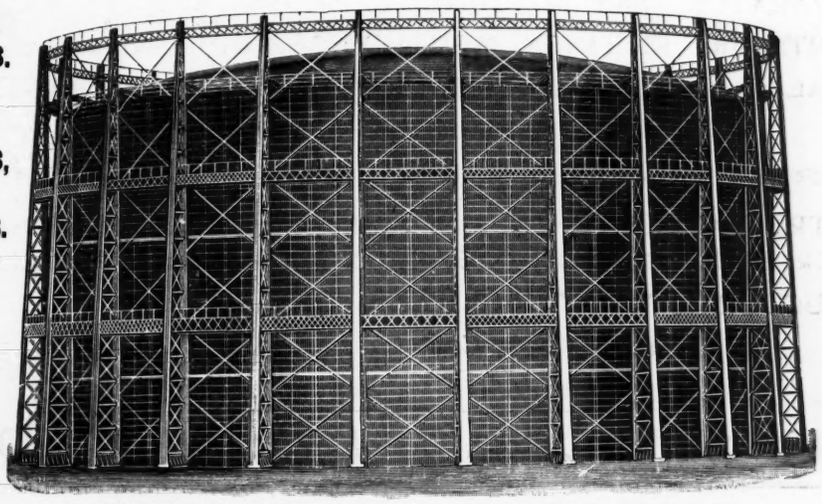

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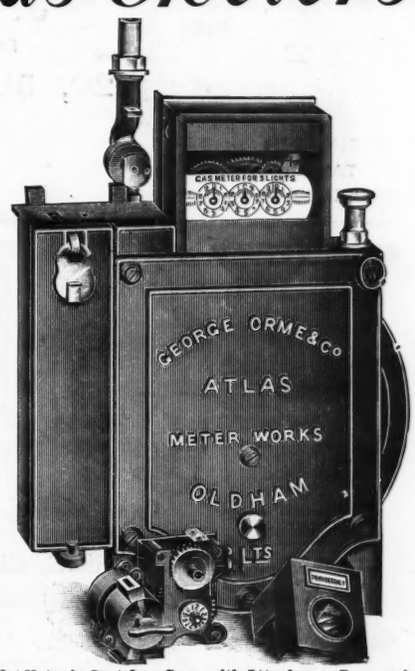

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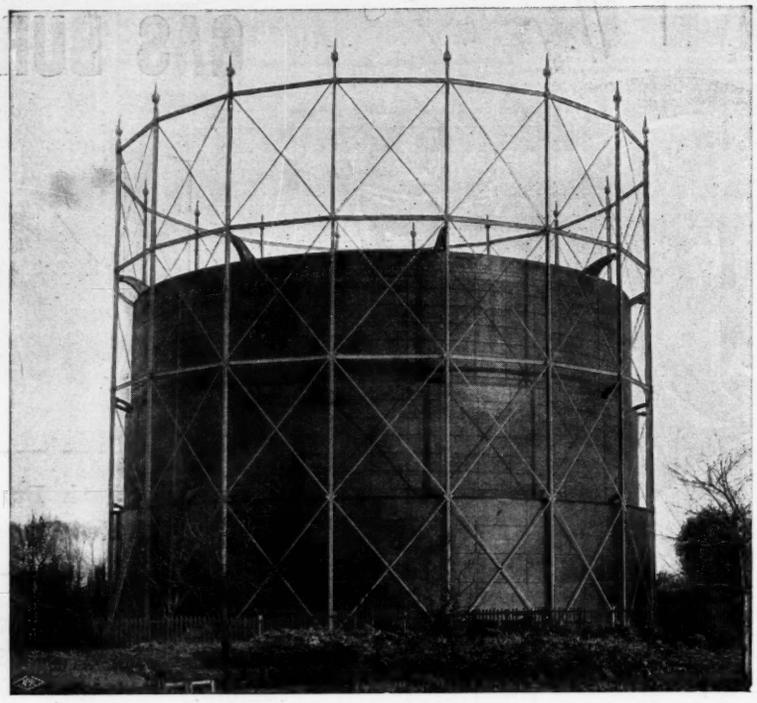

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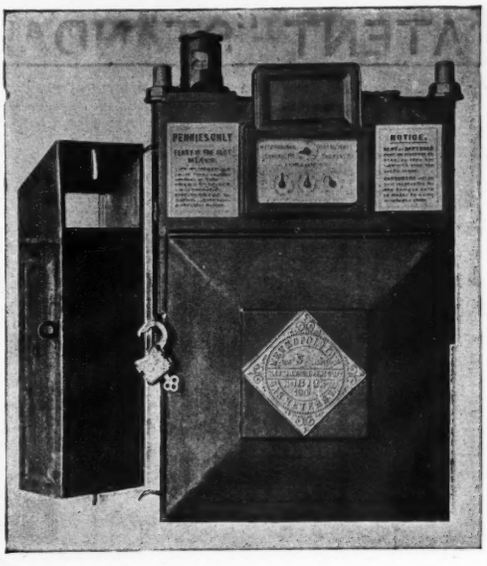

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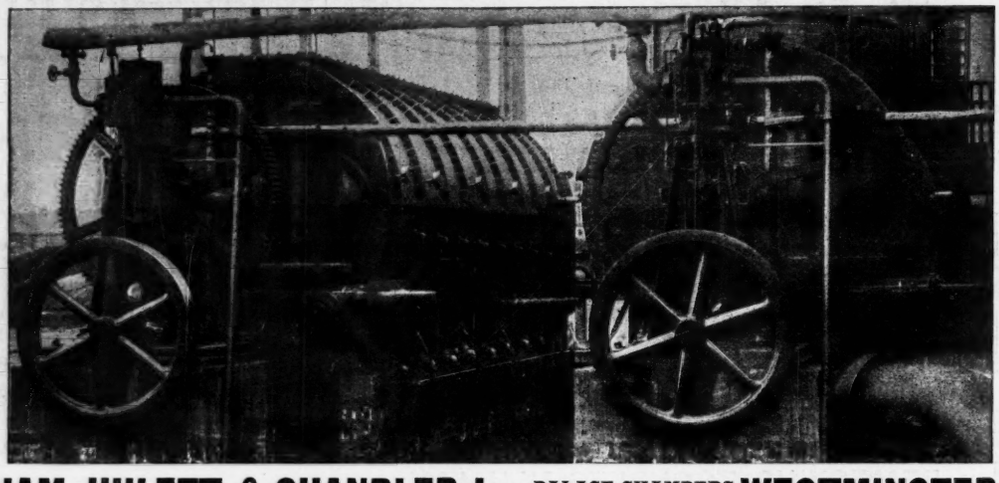

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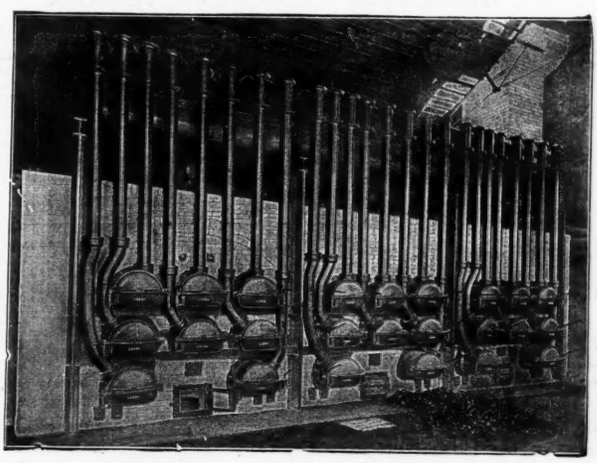

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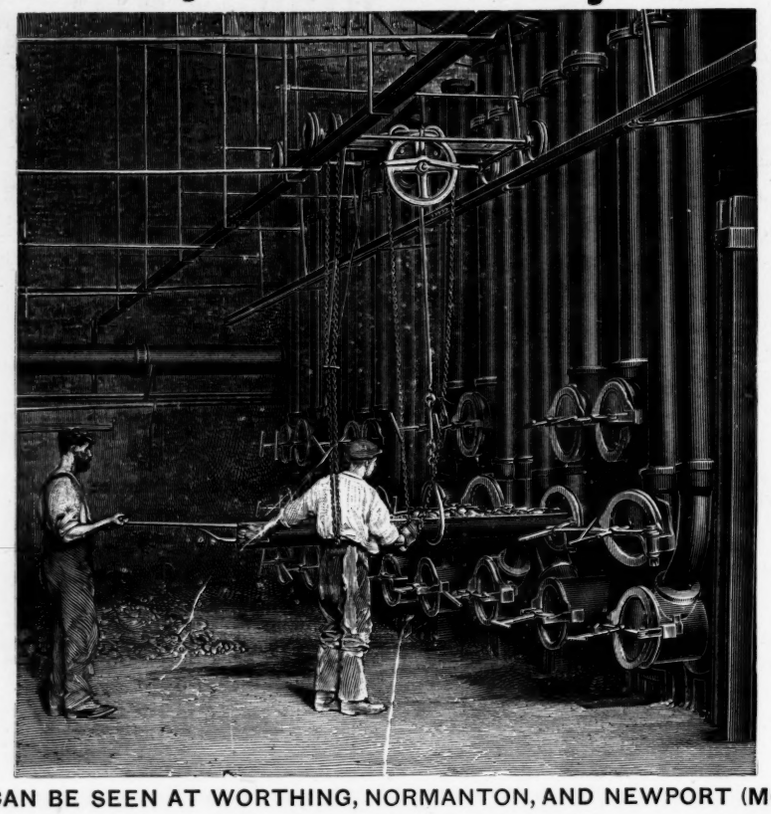

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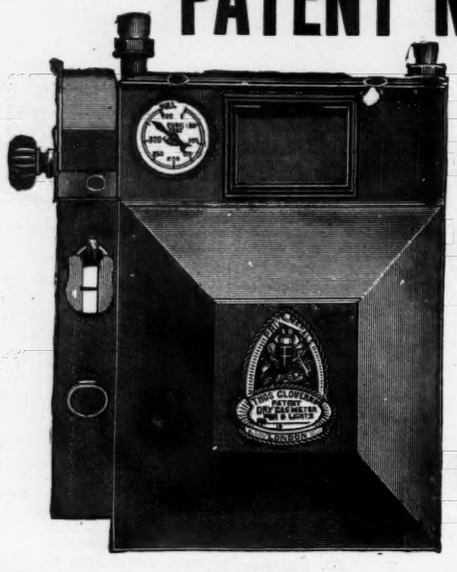

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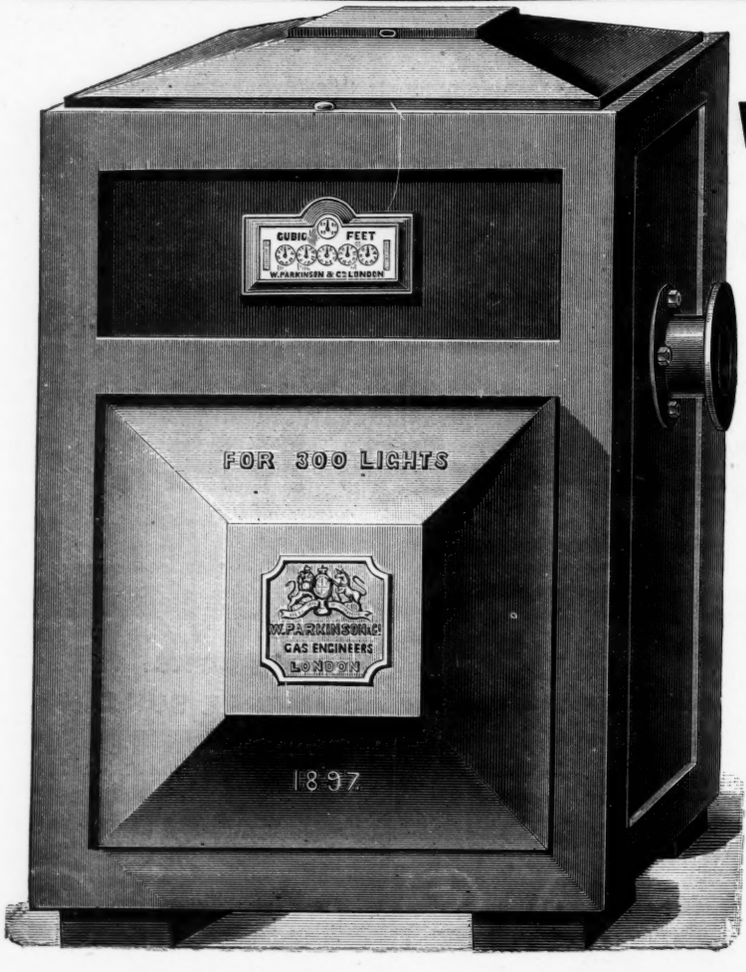

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EDITORIAL NOTES.

The Standard Set of Meter-Unions.

THE attention of the gas engineering trades is invited to the communication of Mr. Walter T. Dunn, the Secretary of the Gas Institute, which appears in our "Correspondence" column to-day. It has reference to the long-standing matter of the standardizing of meter-unions; and it marks what it may be hoped will prove a generally satisfactory termination of the period of uncertainty which has reigned up to the present in this regard. It was agreed at the July conference of specialists interested in the subject, that the set of meter-unions then in possession of the Board of Trade should be recommended for adoption as the standard. It appeared, however, that the matter was not actually ripe for formal acceptance by the trade; and the Glasgow Gas Engineering Conference came and went without it being possible to make an authoritative pronouncement on the subject. Since then, the expected official communication has been received from the Standards Department of the Board of Trade, and our correspondent gives its terms. The marked set of union gauges has now been measured and verified, with the results as published. This settles the matter. Henceforward the "Standard Gas-Meter Union "Gauges, 1901," will govern the manufacture of these articles in the British Empire. The thanks of the industry are due to all those who have been instrumental in systematizing this neglected, but important, part of gas-supply technics. Now we should like to hear what our friends the Metric System enthusiasts have to say about it. Screw-threads have always exhibited a marked objection to be governed by abstract theoretical dimensions. English mechanics, with the immortal Whitworth to systematize their screws in due course, have obstinately preferred a thread which holds and answers well, to anything based on a more or less correct measurement of an arc of the earth's circumference. The impression prevails that English screw-threads are the best in the world; and one would fain believe that the latest addition to the series, now vouched for by Mr. H. J. Chaney, is worthy of the company. Perhaps our American colleagues will take note of the circumstance now made public, and give the industry the benefit of their ideas on the subject.

The Commercial Men and Profit-Sharing.

IT would be a pity if an important announcement towards the end of the speech of Mr. W. G. Bradshaw, at the recent meeting of the Commercial Gas Company, were lost sight of owing to the mass of matter with which it was superposed; and we cannot do anything better in the cause of the efforts which are being made in the gas industry to attach employees to employers by means of the profit-sharing system, than to bring this announcement into special prominence. The fact that the Directors of the Commercial Gas Company had invited their men to participate, on terms, in the profits earned, was published in the "JOURNAL" some time since. There then appeared to us, if we did not say so, to be something bold about this offer; for if we had been asked in which Company next to the Gaslight and Coke any such scheme would have the least chance of success, we should have unhesitatingly named the Commercial, inasmuch as the officials at the headquarters of the Gas Workers' Union are in such close touch with the Company's men, are able to feel their pulse on any and every question, and are able to use personal influence in directing them as the Union thinks fit. But it turns out that their personal influence has had little avail in the settling of the question of the adoption of the profit-sharing scheme. As the "JOURNAL" has recorded, the Union showed some resistance to its introduction; but it was neither strong nor effective. In fact, at the time the Union called conferences of the men, one of our greatest surprises was that the latter exhibited, by paucity of attendance, so much indifference to the Union. At the same time, the passing of the resolutions at the Union meetings in antagonism to the scheme seemed to put its fate into the balance; and it was questionable for a week or two which way the men would turn—whether they would render obedience to the Union or to the dictates of their own consciences. But rumour soon informed us that the men were going strongly for sharing the fortunes of the Company; and it is extremely satisfactory to find that Mr. Bradshaw was able to more than confirm these reports. To be in a position to announce an adhesion to the scheme by over 90 per cent. of the men must be very gratifying to the Directors, and more especially to Mr. H. E. Jones and Mr. George Livesey. All that is left to the Union is less than a 10 per cent. success; and we almost now dare to predict that by the time the men represented by the 90 odd per cent. have their first bonus handed over to them, the remainder will see that there is something more in the scheme than the fetters of slavery. The Commercial men have proved themselves far wiser than their so-called leaders and advisers; and we congratulate them on the choice they have made. That such success should have been secured in the case of the Commercial Company is a point which should be widely known; and it should have a potent effect in the Provinces.

Recent Developments of Labour Politics.

LABOUR politics have been pretty much with us again, in different parts of the country. The Free Labour Association have met in London, and have forced the newspapers to publish something not wholly to the advantage of Trade Unionism. The spokesmen of the Association succeeded in showing up the tyrannous methods of practical Trade Union working, and exposed the one-sided composition of the Labour Department of the Board of Trade. That is a political job which some member of Parliament should set about correcting next session. A weighty contribution to the literature of the general subject was made by Professor Case, in the form of a letter to "The Times" of Sept. 28, which we have waited to notice until the usual crop of comments have been gathered in. Professor Case passed in review the legal position of the labouring classes, showing that they not only have the right to combine to terminate a contract by a strike, which is in itself quite defensible, but that they also enjoy the power of terrorizing people by crowds; and in the last resort play on the sympathies of the public to their own advantage. "People, not realizing "that injudicious sympathy is a vice, all the more dangerous "because it appears to be a virtue, accord indiscriminate "sympathy, sometimes directly in the form of subscriptions, "but more often indirectly in the cheap form of A advising "B to be kind to C." The sarcasm is cruel, but is clearly well founded.

Professor Case was warmly supported by "The Times," in a leader which rubbed in the lesson of "the anomalous "powers which have gradually accrued to Trade Unions "through indifference, laxity in the administration of the "law, and the easy benevolence of a public always ready to "be generous at other people's expense." The chief evil of the legal position which remains after the recent stiffening of the law by the House of Lords is the toleration of picketing. Workpeople have an unquestioned right to leave their employment on proper notice according to the terms of their engagement. Nobody has ever disputed this. The power which belongs to one man also belongs to ten thousand men; and if they elect to use it simultaneously, they are at liberty to do so. This power of combined action to do a perfectly legal thing is quite as formidable a force as any body of men can safely be entrusted with. But, as everybody knows, the Trade Union begins to exert its peculiar privilege where the legal right of the individual workman leaves off. A man who willingly abandons his employment has done with his employers. He gets his wages, and has no more part in the establishment he has left. But, by a strange slip of the Courts, the law admits that he has a right to hang about the scene of his former labours, and coerce both his old employers and those who are willing to take his place. As Professor Case puts it, the workmen who have left their employment by the explosive path of a strike are still "the men." As such they are gratuitously endowed with claims upon their old employment, which those who leave it in the ordinary way never dream of arrogating to themselves. If strikers were conscious of being only "the former men," and were so

treated by the State and Society, they would never dare to behave as they do.

If a workman does not think a contract of labour is good enough for himself, he ought to stand aside and let others take it if they will. But that is precisely what Trade Unionism declines to permit. Then, as though to condone and reward all this, the State steps in and offers to "arbi- "trate" between the employers and the men who have been guilty of this terrorism, and, of course, as we have already pointed out, the strike system is not the worst of the effects of Trade Unionism. The statistics of the Labour Department of the Board of Trade, showing that strikes affect but a small percentage of the workmen of the country in a particular year, are beside the point. "The laws against theft "affect only a small percentage of the community in any "given year; but, if they did not exist, no man's property "would be safe for a day. So we cannot measure the effect "of the Trade Union system as at present countenanced "by the law and the flabby sentiment of the public by "the number of strikes or their direct money loss. Strikes "are the ultimate sanction of a system of interference with "industry. It is only in extreme cases that they come into "play; but the fear of them is a perpetual paralyzing force. "Capitalists do everything that is possible to avoid a total "breakdown, and to save themselves from ruin should it "occur." Nobody can doubt that half the great industries of the country are affected by this creeping paralysis. If the workpeople in Trade-Union-ridden employments were required by the employers to work as they did under what were once the normal conditions, they would strike forthwith; and all the glozing statistics of the Labour Department would be knocked higher than Gilderoy's Kite.

Mr. Bramwell Booth, who cannot be accused of lack of sympathy with the British workman, knows this vice of Trade Unionism; and he lays it bare in a letter to "The Times," which nobody on the other side has attempted to answer. He calls it "the widely-spread habit of restricting the work "which a man can with reasonable industry accomplish in "the time for which he is paid by his employer." This habit, which was brought home to several of the apologists for "organized labour" before the Royal Commission, is chargeable with manifold and great mischiefs. Not only does it so increase the cost of production as to check the undertaking of work that would otherwise be given out, but it is in the highest degree detrimental to the moral character of those men who practise it. This is not calculated to surprise the ethical philosopher, who knows very well that no man can go on outraging a recognized obligation of the moral law without suffering some degradation. Mr. Booth appeals to "such men as Mr. Burt, Mr. Hardie, Mr. Fen- "wick, and Mr. Bell," to "warn the people with whom they "rightly have such enormous influence to make an end for "their own sakes of this miserable contrivance for mini- "mizing the good work a man can do in the world." Alas! the poison has penetrated too deeply into the whole Trade Union system. The bricklayers lay fewer bricks every day, until the employer becomes bankrupt; and then the workmen either go off to ruin some other "master," or to emigrate to the United States, where they find it expedient to drop all this nonsense. Next, we hear of the vast superiority of American workshop methods as compared with the English ones—the reporter omitting to state that some of the smartest so-called American workmen are expatriated Britons who have found it expedient to work hard, as an alternative to starving in the midst of plenty. For there is no mercy for strikers in the Land of the Free.

Breaking-up Streets.

A good deal has been said during the past week, at meetings of Metropolitan Local Authorities and in the newspapers, about the opening of the streets of London for main-laying purposes. Some of the principal streets are "up" again, and Blackfriars end of the Victoria Embankment is closed for the annual remetalling, which makes this thoroughfare one of the costliest of Londoners' luxuries. Naturally, the London County Council have been "approached" on the subject; and the inevitable response was that, while the Council would be only too happy to undertake the care of all the Metropolitan highways and byways, as a matter of fact they are not the highway authority. The remarkable thing about these appeals to the County Council is the assumption of those with whom they originate—that if only the Metropolitan streets were entrusted to a single authority, such as the County Council, these upheavals would cease. According to their habit, the County Council encourage this childlike faith; it being their settled policy to make the public believe in their inborn capacity to manage everything better than the people whose business it happens to be. Really, public opinion appears to be more than a little weak and credulous in this regard. The Corporation of the City of London actually have the single power over the streets within the City proper that the County Council covet for the rest of London; and yet they cannot stop the excavations. A report on the subject was recently presented to the Common Council, in which prominence was given to the legal fact that six Companies possess the power of using the subsoil of the City streets; though it had to be admitted that several of them no longer exercise it.

Here is the trouble that Gas and Water Companies have to meet: All the street dislocations are immediately put down to them, in the popular mind; whereas they are usually the least of sinners in this respect. The Corporation had to confess that it was the Post Office which had made the most disturbance; and the new competing electric light supply in the City came next. There it is—the public clamour for more telephones, and for competition in electric lighting; and then, when the consequential road openings are made, they raise an uproar like a spoilt child that has cut itself with a much-desired toy. One reasonable grievance the frontagers certainly have in all these cases. The work might often be done quicker and with more regard to the business requirements of the street. But does any sane person believe that matters would be mended in this respect by enthroning the Trade Union paviors and general labourers of the London County Council on the abolished powers of the subsoil-using companies? Why does not somebody inquire how long it takes the Council to do a job of street work, as compared with the Companies' contractors? It is a wholly pertinent question that some really public-spirited member might make his own. A report from the Highways Committee is on the *agenda* for the meeting of the Council to-day, suggesting the co-operation with them of the Corporation and the Councils of the Metropolitan Boroughs and of Westminster in representing to the Government the necessity for legislation empowering the Council to make bye-laws on this matter, and to enforce compliance therewith.

The Virtue of Being Dissatisfied.

A very wonderful gift has Lord Rosebery for catching the national ear. Every important speech he makes awakens serious interest in the mind of the public; while his minor speeches are universally welcomed for their charm. For this very reason, every speech he makes only deepens one's regret for the fact that he still adheres to his self-limited sphere of usefulness—remains outside the arena of practical affairs, to the actors in which he from time to time gives much sound advice, preferring the post of Public Monitor to the position of a combatant. His strictly non-partisan attitude, however, has its advantages; one being that his addresses can with propriety be discussed in a non-party journal, and the lessons that he so eloquently expounds be considered from the point of view of those engaged in the commercial enterprises that form so important a part of our national life.

The gospel which Lord Rosebery preached on Tuesday last to the students at the Birmingham and Midland Institute, was the virtue of being dissatisfied—not with our lot in life, but with our achievements. This he summed up in a noteworthy aphorism: "The nation that is satisfied is lost." We want more, he said, of "the spirit of hungry intelligence "and righteous ambition"—the spirit of honest dissatisfaction (as opposed to torpor and complacency), founded, not upon ignorant impatience or on mere envy and jealousy, but on the desire to achieve the highest possible, "the definite dis- "content represented by the motto 'Excelsior.'" What is true of the nation is true of the individuals, and the corporations of individuals working for a common purpose that are represented by the term "a business." The business which is satisfied is lost. The business which is not progressive is retrograding. "Rest and be thankful," is a motto which spells decay. This is not a new gospel to our readers; but it is one that may well be preached time and again.

There are, happily, not a few men in the gas industry possessed of that "disdain of finality, the anxiety for improv- "ing on the best," which, as Lord Rosebery says, so nearly approaches a disease in the American manufacturer that no accumulated fortune, however gigantic, appears to satisfy or to be sufficient to allow of leisure and repose; but we need

many more of them. The question that should ever be raising itself before the mind of the gas manager is not, Are we doing well? but, Are we doing the best possible? To quote another noteworthy dictum of Lord Rosebery: "Com- "placency is a fatal gift," and its spirit must be exorcised if success is to be attained. The "treasured English axiom," "What was good enough for my father is good enough for "me," has survived to this day in some quarters—though surely not in any where Sydney Smith's "Noodle's Oration" has been perused. As that eminent divine, and still more eminent wit, observed: "To say that all things new are bad, "is to say that all old things were bad in their commence- "ment; for of all the old things ever seen or heard of, there "is not one that was not once new. Whatever is now estab- "lished was once innovation. The first inventor of pews "and parish clerks was no doubt considered as a Jacobin in "his day. The fool sayeth in his heart and crieth with his "mouth, 'I will have nothing new.'" We none of us like to be classed with the fools, yet that particular variety still takes his walks abroad—or sits in his managerial chair.

Lord Rosebery touched upon his favourite subject, commercial education—"a necessity only second to the organiza- "tion of adequate defence," both of which urgent needs the nation will obtain, "like everything else, when it makes up "its mind to have them, but not one moment before." With that biting remark, which calls up the rejoinder, "Will you "lead us in our fight for them?" he at once passed on to a subject that we have discussed before in the columns of the "JOURNAL"—the need of independent thought; that is to say, of thinking things out for one's self, instead of buying all one's opinions ready-made for a penny, or maybe a half-penny, a day. "The mere fact of reading simply to occupy "a vacant mind is nothing." How we would like to stamp that across every page of the appalling mass of scrippetty publications that are so eagerly devoured by such a vast number of people day by day! As Lord Rosebery says, "fond parents are proud and satisfied if only they can see "their children reading . . . the mere fact of holding "an open book on which the eyes are fixed, covers a multi- "tude of sins." To what good they are reading, it never enters the mind of children or of parents to ask. Better, almost, were it never to have learnt to read, than to have done so but to read without purpose and without thought. A man is not educated if he can read, but cannot think and *do*. "The grand result of schooling," said Carlyle, "is a "mind with just vision to discern, with free force to do; the "grand schoolmaster is Practice."

This capacity for being able to think clearly for one's self is, in very truth, one of the most obvious needs of the present time. As in our political and military affairs, so in our commercial, we want an ever-springing well of fresh thoughts and ideas, combined with that sceptical spirit of inquiry which animated Professor Rücker's address to the British Association; the attitude of mind that does not accept former practice as being of necessity the best, nor current theory as being necessarily founded upon ultimate truth. That is what has brought the gas industry so far on the path of progress as it has reached; and nothing but that will carry it, as it must to maintain its position go, ever onward.

Gas-Engine Research.

THERE can be no two opinions as to the value of the careful research which is being made under the auspices of the Institution of Mechanical Engineers into the conditions and the phenomena which obtain during the working of a gas-engine. No better body than this composite engineering organization could have undertaken such a work as this. The Institution embraces in its ranks just the ability required for the purpose; and it can command the necessary funds. Our only regret is that the gas industry, which will derive some of the ultimate advantage of the inquiry, is not taking an intimate part in it. But this may arise from the simple fact that the assistance of our technical societies has not been sought. However, this being so, the greater will be the obligation of the industry to the Institution of Mechanical Engineers. In writing thus, it is not intended to insinuate that an addition from the gas industry would result in the inquiry being conducted with any more skill or care. That would be impossible. But at the same time one cannot help feeling that with such an investigation the gas profession and its representative bodies ought to be identified.

As originally constituted, the Committee consisted of Professor A. B. W. Kennedy as Chairman, Professors Frederic W. Burstall and W. C. Roberts-Austen, and Messrs. H. R. J. Burstall, Bryan Donkin, John Fielding, W. H. Maw, James Platt, and Charles J. Wilson, F.I.C. We believe that there will be some important additions in the immediate future; but until the consent of the proposed new members has been obtained, of course no public mention can be made of their names. Professor Kennedy's effective work in connection with the Society of Arts gas-engine trials of 1888 will always be remembered with gratitude; and Mr. Bryan Donkin's presence on the Committee puts, in the eyes of the gas profession, an increased value on their labours. We have only to refer to the first report of the Committee in 1898, and to the present one, for proof of the care, skill, and frankness of the Committee's investigator and reporter, Professor Burstall. Upon him the actual work falls. The methods he has adopted, and his reasons for their adoption, are fully unsealed in the reports for the criticism of anyone interested.

The volume of the work already accomplished is great; and there are signs of a considerable development in the next two or three years. The contemplated additions to the Committee is one, and another is that arrangements are being made for replacing the small gas engine on which the trials have so far been made by one of 150-horse power. The change will brush aside the slighting reference made early in the investigations to the value of results obtained by such small means as a 5-horse power engine. In perusing the extracts we have given from the report, and the account of the discussion which has so far taken place, the points which will impress the reader are those referring to electric ignition, the influence of compression, the suction temperature, and the variable temperature in the cylinder. On two or three of these questions, we have some really new, definite, and trustworthy information on which to work. We will not abet a disregard of the report given in other columns by condensing here the statements made on the points mentioned. The detailed manner in which everything is presented by Professor Burstall is an invitation for comment; and if any of our readers have criticisms to pass or suggestions to make, now, before the work is continued, is their time.

The First Mond Gas Act.

IN another column will be found an abstract of the South Staffordshire Mond Gas (Power and Heating) Company's Act, which is well worth reading by those who are concerned with the administration of gas undertakings of the ordinary kind under statutory regulations. Its differences from the usual run of Gas Acts, as well as its resemblances to them, arrest attention. It is not for us to discuss the general question of the reasons that prevailed with Parliament to the extent of carrying the preamble of the Bill. Still less is it pertinent to inquire whether the Act as passed is very well worth having. It is a far different compilation from the scanty proposals originally contained in the Bill. The skeleton, of course, remains—that is, the preamble; but the body of the measure has been changed out of knowledge. In many respects it is modelled on an ordinary Gas Company's Act—as is inevitable, seeing that it is a kind of Gas Act. The first difference starts with the exceptional complaisance of the Act to local authorities. The undertakers are willing to do anything and everything "to oblige;" with the result that the smallest District Council can ride them on the curb, so to speak. Is it a matter of opening the roads? Then the Company will be delighted for the highway authorities to do the work on their behalf, charging them with the expenses. If the local authorities do not have new roads throughout their domains at the cost of the Company, they are not of the mettle we take them to be. The main-laying experiences of the undertakers under this Act are likely to be peculiarly interesting.

This interest attaches to the new venture from its cradle to its grave; for, after making elaborate and searching provisions for the protection of the roads during the process of main-laying for fuel gas, certain of the local authorities—as, for example, the Corporation of West Bromwich—do not let the Company go in the event of their insolvency. Probably warned by the history of the Birmingham Compressed Air Power Scheme, this Corporation warn the Company that if they go the same way, they will either remove the mains and apparatus at the expense of the Company, or purchase them at a valuation. But, it may be asked, where is the cost of removing the mains to come from if the Company should be insolvent? The Corporation deal with this point by taking powers to require the Company to deposit with them in advance the estimated

cost of removing the derelict property; failing which, the property passes to the Corporation. Verily, they are shrewd people in West Bromwich and the neighbourhood; for this provision is repeated in several instances. It is not necessary to discuss the prices and other conditions of supply accepted by the Company. There is something fresh, however, about the measurement of the supplies by means of proportional meters. These appliances are placed under the jurisdiction of an inspector under the Sale of Gas Act, 1859. A proportional meter, as defined by the Act, means a meter which measures and records a constant fraction of the total quantity passing through the meter. A remarkable instrument, if it does this!

Curiosity is likely to be felt in regard to the obligations laid upon this fuel and power gas Company with respect to the quality of the article they propose to sell. What is the buyer to have for his money? Every consumer is to get his supply, whatever it is, under "adequate" pressure, subject to a maximum penalty of 40s. per day. Nothing is said as to what is an adequate pressure, who is to be the judge of the fact, or over what hours of the day the hazy obligation is to extend. It is not lawful for the Company to supply gas containing more than 14 per cent. of carbon monoxide, or which does not possess a distinctive and readily perceptible odour. Contraventions of this enactment are punishable by a fine of £50; and the Inspectors of Factories or of Mines are charged with seeing to this matter. Testing-places are to be provided at every manufacturing station of the Company, where officers, appointed by the local authorities or the justices, may test the gas sent out for carbonic oxide and thermal power. The latter is a new order. The method of procedure is to be prescribed by the Board of Trade at the Company's expense. The minimum thermal power of the gas supplied by the Company—that is, sent out from the works—is to be 125 B.T.U. per cubic foot at 32° Fahr. and 30 inches of barometric pressure; the product of combustion being cooled to 60° Fahr. This is not a very strong gas. A producer gas of this grade, owing its calorific value to hydrogen, will ignite in the cold; but there is not a great margin of inflammability. A satisfactory clause of the Act makes the Company answerable for all accidents, damages, and injuries happening through any act or default of the Company, their contractors, and servants, and holds all corporations, companies, and persons harmless in respect of all damages and costs in regard to such damages. This provision may come useful when their new mains are being brought into service.

WATER AFFAIRS.

Sanitary Institute Conference on Water Supplies.

THE Conference on Water Supplies and River Pollution which took place in London last Wednesday and Thursday, under the auspices of the Council of the Sanitary Institute, opened under meteorological conditions singularly appropriate to the subjects discussed. Rain fell pretty heavily; but it did not deter the delegates, who were fairly representative of the various interests concerned, from assembling in goodly numbers. It will be seen, by the report which appears elsewhere, that the proceedings opened with the announcement of the inability of Sir Alexander Binnie to preside, as had been arranged, over the first day's deliberations, owing to a severe bereavement; and his place was taken by Professor Henry Robinson. There were altogether fifteen papers down for discussion; and had not the wise course been followed of distributing prints a few days in advance of the meeting, it would have been impossible to deal with them. This prior circulation, however, allowed of the papers being taken as read, and some of them grouped and considered together. The subjects brought forward on the first day, as will be noticed from our report, dealt with sources of supply, watershed areas, underground water, and town and village supplies; those considered on Thursday, when Mr. W. Whitaker presided, bearing upon storage, filtration, and purification. They were well discussed, so far as time would allow; and when the abstracts of the papers, with the remarks on them, are given, opportunity will be taken for noticing some of the salient points. It will be sufficient now to say that the trend of the discussion on the first day was in the direction of requiring all water supplies to be placed in the hands of representative bodies directly responsible to the consumers, and the enlargement of the powers of County Councils so as to include the supervision and control of the supplies in their respective areas. These views were embodied in two resolutions which are to be submitted to the Council of the Institute, who, by a third resolution, are asked to urge County Councils to investigate the existing conditions of the water supplies within their districts, with special reference to quality and quantity, and record the results. As no similar collective pronouncement was made on any of the subjects discussed on Thursday, these resolutions may be regarded as the practical outcome of the Conference; and it now remains to be seen what steps will be taken by those who convened it to give effect to the expressed wishes of the delegates.

It will be interesting to watch the result of last week's gathering, seeing that, as Professor Robinson pointed out in his introductory remarks, a similar conference which took place at the Society of Arts some quarter of a century ago had been practically fruitless. He told the delegates that in the important matters of the better preservation of watersheds, the conservation of flood waters, and the pollution of rivers, but little had been done. One can hardly suppose that the proceedings of last week will be equally barren, especially as they will constitute those who initiated them a third power which is being brought to bear upon the solution of the problems involved. In the first place, the British Association of Water-Works Engineers have decided, as Mr. Percy Griffith, the Secretary, informed the meeting on Wednesday, to proceed with the collection of data in regard to the water supplies of the country, in which useful work they will be glad to receive assistance from anyone in a position to render it. Already Dr. Thresh has published a highly instructive report on the water supply of the county of Essex; and he thinks that County Councils should have power to employ experts to collect information of this kind. The papers prepared for the Conference, and the report of the discussions thereon, will, in their collected form, place valuable data at the disposal of the Council of the Institute in any action they may take. Finally, the Committee of the County Councils Association have drafted a Bill to authorize the Local Government Board to constitute, by Provisional Order, a water authority for the control of a specified area, on proof being given to them that the formation of such a body would be of local and public advantage.

If the enlarged powers asked for in the resolutions passed on Wednesday are as urgently needed as the Conference would have us believe, the concentration of these forces surely ought to be efficacious in obtaining them. But are they urgently needed? Are the powers already granted in this regard used to their full extent? According to one speaker, they are not. Be this as it may, a general feeling was manifest at the meeting that something must be done to place the water supply of the country upon a different footing from that on which it now rests. Whether this object can best be attained in the manner indicated by the resolutions, is a question open to discussion. The matter is one which, as the delegates recognized, concerns the entire kingdom, and therefore is of national importance; and it appears to us that, sooner or later, it will have to be dealt with, in conjunction with other subjects bearing upon the public health, by a specially constituted Department of State, on the lines of the Massachusetts Board of Health, as was suggested some time ago by Dr. Percy Frankland.

The London Water Supply Last Year.

IF anyone is to be found who still entertains the notion that the London Water Supply is not well looked after, he cannot do better than procure and study the recently issued annual report of the Local Government Board, a by no means insignificant portion of which is, as usual, devoted to this subject. It is first of all dealt with in the body of the report, which bears the signature of the President (Mr. Walter Long), and subsequently in much greater detail in one of the appendices. It will suffice for present purposes if we extract the salient points in Mr. Long's story, which is, of course, founded upon the full reports submitted to his Department by the Official Water Examiner, Mr. Charles Perrin, M.Inst.C.E., and by Dr. T. E. Thorpe and Mr. Allan Stoneham, the Government Analyst and the Official Auditor. According to the particulars furnished to the Board by the first-named gentleman, the total population supplied by the eight Metropolitan Water Companies on the 31st of December last was approximately 6,165,490, as compared with 6,020,845 on the corresponding day the previous year. The

average population served during the twelve months is put at 6,092,536, against 5,948,338 before. The total average daily supply was 212,048,626 gallons, or at the rate of 34·8 gallons per head, as compared with 35·35 gallons per head in 1899. There was consequently half-a-gallon less water consumed per head last year than in the preceding twelve months. The water thus distributed was derived from the Thames and the Lea, from springs in the Lea Valley, and from 38 wells in the chalk and greensand formations. Of the entire bulk of water coming down the Thames last September, 38·1 per cent. was withdrawn for the supply of the Metropolis; whereas in the corresponding month of 1898 it was 63·7 per cent., and in August in the following year 64·8 per cent. This was a very high proportion; but in February, 1900, the quantity withdrawn amounted to only 2·6 per cent. Altogether, the conditions which obtained during the year were considerably more favourable than those of 1899. The average daily discharge of the Lea, added to the quantity abstracted for water supply, amounted to 325·2 million gallons in February and to 18·8 million gallons in September—these figures representing the maximum and minimum amounts respectively.

So much for quantity. Let us see what the report has to say about quality. During the past year, 560 samples of water were examined by Dr. Thorpe. Naturally, the water supplied by the Kent Company, being drawn from the chalk, kept its place at the head of the list in regard to its freedom from organic impurity. But during certain of the summer months that of the New River Company approached it pretty closely, and was always purer than the water of the East London Company, which, in its turn, was of better quality than that sent out by the Companies drawing their supplies from the Thames. But there is nothing to be alarmed about, though the opponents of the Companies try to frighten people into believing that they are being poisoned by Thames water. It would be folly to deny, in the face of the results of the chemical examination of London water presented in the report, that the raw waters of the Thames and Lea contain organic matter of both animal and vegetable origin; and, under "ideal conditions," as Dr. Thorpe points out, the use of such water would be avoided. Unfortunately, the inhabitants of the Metropolis do not live under such conditions; and until they do, they have to follow the advice of the poet, and "take the good "the gods"—in the persons of the Directors of the Water Companies—"provide." But in these trying circumstances they may also take to heart the "comfortable words" of Dr. Thorpe, who assures us that experience and research have shown, in the case of the two rivers in question, that, provided certain flood water is excluded, and the water taken is properly stored and afterwards efficiently filtered, "the "risk of danger to the public health through consuming such "water is reduced to a minimum, *if not to zero*."

Ample storage capacity and efficient filtration, then, are the chief conditions precedent to the realization of this high ideal of absolutely safeguarding the public health. Do the Water Companies recognize this, or are the eyes of their Directors closed to everything but the making of "bloated "dividends" for their shareholders? The Official Water Examiner shall answer the question. He shows that considerable progress has been made of late years, by the Companies deriving their water from the Thames, in the provision of additional reservoirs; the storage having been increased from 496 million gallons in 1892 to 1210 million gallons last year. When the reservoirs now in course of construction and those sanctioned have been completed, the Companies, other than the East London, who draw their supplies from the Thames will possess storage capacity equal to 5829 million gallons. As far as filtration is concerned, both the Southwark and Vauxhall and West Middlesex Companies made additions to their filter-beds last year; and those of the former Company have been brought into use. That there is no desire to "starve" the works is shown by the fact that the capital expenditure of the eight Companies last year amounted in round figures to £762,000, a good deal of which was incurred in carrying out the scheme of intercommunication between their systems, on which £160,000 had been spent between Sept. 1, 1898, and the close of the year 1900. It may be added that the Companies required to form sinking funds paid over to the Chamberlain of London £14,396 in the past twelve months; bringing up to £51,508 the total payments into his fund, with accumulations, up to the end of the year. Here, for the present, we must leave this interesting report.

ESSAYS AND REVIEWS.

MR. LIVESEY IN DEFENCE OF PROFIT-SHARING.

In the current number of the "Economic Review" (Rivington's), appears a reply from Mr. Livesey to the criticisms of profit-sharing made in the January and July numbers of that publication by Mr. W. H. Lever. With Mr. Lever's arguments we dealt somewhat fully at the time his articles were published;* but Mr. Livesey speaks with such peculiar authority upon the question, and his reply puts the whole case for profit-sharing so clearly, that we may well return to the subject to notice the arguments with which he meets those of Mr. Lever.

In his articles, it may be remembered, Mr. Lever declares his preference for what he calls "prosperity-sharing" to the system of "profit-sharing"—both of which terms are, as Mr. Livesey says, evidence that Englishmen have not the gift of word-making—the former scheme being designed to attach employees to the service of their employers by the voluntary provision, by the latter for the former, of such things as clubs and recreation-grounds or low-rented houses. This, excellent in itself, forms no durable bond between capital and labour, as we endeavoured to show; and Mr. Livesey takes the same view. He holds that, in the first place, such a plan is not practicable for the great proportion of employers, and, in the second, that, even were it practicable in all cases, "prosperity-sharing," as defined by Mr. Lever, would not attain the end which all employers have in view—"the reconciliation of capital and labour."

We do not want to reduce a man's self-respect and independence by any acts of benevolence; we want, on the contrary, to increase his sense of self-reliance, and to lift him to a higher plane than that of the wage hireling, uninterested in the well-being of the business for service in which he is hired. As Mr. Livesey puts it, the worker who was once a slave, then a serf, and now a hireling, must go higher still, and reach the position of a partner, if the best possible is to be attained by him and by the undertaking for which he labours. "The wage system is one of transition. But what is the goal? Surely partnership in some form; and the more complete it is, the better. Partnership in profit and loss, in responsibility, and in management. If business is to be successful, capital, labour, and (to use Mr. Mallock's word) ability, are essential. All are absolutely necessary to success, and no one or two can accomplish anything without the complete trio."

Mr. Livesey easily disposes of a fallacious argument advanced by Mr. Lever and other employers—critics of profit-sharing. He and they argue that, inasmuch as labour is entitled to receive its wages whether the business makes a profit or not, capital has a natural objection, and is right in objecting, to labour claiming any share in such profit as may be made. But the advocates of profit-sharing do not admit that labour, under ordinary conditions, has a natural right to anything beyond the wages of hire. To earn such a right, the worker must be prepared to give something beyond what he would ordinarily give in return for his weekly wage. The point is, in Mr. Livesey's words, this: "What is the nature of the bargain between capital and labour; what does the former buy, and the latter sell, for the wages paid and received? Is it merely so much time, in which an average amount of labour is to be performed, and nothing more? In that case, I agree with Mr. Lever that there is no claim for a share in profits. But is this all the labourer has to sell and the capitalist wants to buy? The labourer can give hearty, interested, intelligent service; but mere day wages will not buy it. This, however, is what the employer most wants, and for which he is quite willing to pay. A great employer once asked me a question on the subject of profit-sharing, to which I replied by another question: 'Is not the man who takes an interest in his work worth 5 per cent. more than the ordinary workman?' He replied: '5 per cent.? Say twenty!' It may be argued that it is the duty of the labourer, in return for his wages, to give more than his time and an average amount of labour. I question that statement. The wages currently paid are the wages of mediocrity; the rate is not that which would willingly be paid if labourers generally gave hearty, interested, intelligent service. For this immensely valuable extra, the employer ought to pay, and is quite willing to pay, well." And that is what profit-sharing, skilfully designed and carefully and patiently managed, can buy. On the last point, Mr. Livesey rightly lays emphasis; its neglect having caused the failure of more than one scheme. "Profit-sharing," he says, "is a business, and not one of the easiest to work successfully. Like all other businesses, to be a success, it must be worked heartily, interestedly, and intelligently by the capitalist, employer, or manager." It is not enough merely to launch a scheme of profit-sharing and expect it to make itself a success. That way failure lies.

The fact that "to increase the rate of wages would not effect the object, because men would practically have the increase, and the good workman would notice that the indifferent received just the same pay as himself, though worth much less," leads to a discussion of the question of how to avoid the same difficulty in regard to profit-sharing, the privileges of which, if granted indiscriminately, are likely to fail of full effect; the whole thing tending to become a matter of course. The problem is to ensure

* See "JOURNAL," Vol. LXXVII., p. 260, and *ante*, p. 499.

the obtaining of that for which the bonus is granted—whole-hearted, zealous, intelligent service. Mr. Livesey has made this problem so especially his study, and has been so successful in its solution, that we will quote in full what he says on the point:

I daresay it will be said that, as it is not practicable to discriminate between the good and the indifferent workman in the matter of wages, it is equally impracticable in the case of profit-sharing. Here I join issue. It is quite practicable, and is being done on a large scale at both the Gas Companies above mentioned [the South Metropolitan and Crystal Palace] with great advantage all round. It needs the exercise of certain qualities by those in authority—first and foremost, justice tempered with mercy, painstaking consideration, and the will to take the necessary trouble to do what is right. The method which we have found practicable is as follows: A prime condition of profit-sharing is that all profit sharers shall work under agreement for periods of not less than three, nor more than twelve months. In starting the system, it was assumed that every man who had been in the service a year was a good workman; and agreements were offered to all. Some few men, after they got their agreements—which bound the Company to give them twelve months' work—feeling they were safe, showed a spirit of insubordination. But they were dealt with by being told that unless their conduct improved, their agreements would not be renewed. Others have from time to time shown a want of interest in their work; and these, when their agreements expire, and they apply for a renewal, are told that they may apply again in three months, and then, if they have improved, they are given a short-term agreement—for three or perhaps six months, instead of a year. This is infinitely better than reducing an indifferent man's wages, or threatening him with dismissal, or discharging him; for it gives him encouragement to try to do better, and is generally effective.

Mr. Livesey goes on to refer to Mr. Lever's strong objection to these contracts of service, and recounts, what we quoted when dealing with Mr. Lever's article, the steps taken by him with success to satisfy the late Mr. Mundella that these contracts were valued, not disliked, by the men themselves. The workmen section of the Profit-Sharing Committee, it will be remembered, upon being asked for their views, entreated Mr. Livesey to say nothing whatever to the men—assuring him that he had no idea how it would upset them if the agreements were abolished. "They even went so far as to say it would be nearly as bad as to abolish the profit-sharing. I reported this to Mr. Mundella; and he, broad-minded man that he was, replied, without hesitation, 'I am satisfied.'" Mr. Livesey proceeds:

The reason for the attachment of the men to the agreements is not far to seek. To them the security of twelve months' regular work is very valuable, and is greatly appreciated. Moreover, while the agreements bind the Company, they do not bind the men individually. I felt it would be hard to deprive any man of the opportunity he might have during the running of his agreement to improve his position. A proviso was therefore added to the effect that no obstacle would be put in the way of any man wishing to leave—provided the manager of the works could dispense with his services without detriment to the Company; and in that case leave would be given to depart at a week's notice. Such leave has never been refused to any man during the twelve years. If all the men wished to leave on the same day—to strike, in fact—leave would not, of course, be given. The value of the agreements therefore to the Company is that they render a strike impossible; and it ought to be impossible in such a business as the supply of gas, on which not only the convenience but the safety of the public so greatly depends. The agreements are necessarily made at different times, and therefore do not expire at one time. This renewal is regarded as a privilege by the men, and is made a matter of consideration by the manager, but is not left to the decision of any foreman or subordinate officer, and any man can appeal to the Chairman (myself), if he wishes to do so. I have occasional appeals; but they more often come from the manager, who asks whether he ought to grant so-and-so a renewal of his agreement.

Mr. Lever must indeed be hard to convince if these statements of Mr. Livesey's leave him "of the same opinion still" as regards the contracts of service required from the workmen.

Mr. Livesey explains briefly the past and present relations between the South Metropolitan Company and the Gas Workers' Union, especially the circumstances which led the Company in 1890 [not "1900," as printed in the "Economic Review"] to refuse employment to any member of that Union. As is known, the Company now merely ignore the Union—that is to say, on taking on a man, no question is asked as to whether or not he is a member, the notice as to non-employment of Unionists remaining nominally in force. "It is, however, right to say that, even were the notice withdrawn (I have always been told by representative men that to do so would shake the confidence of the men generally), we should in no way recognize the Union, or allow its officials to interfere between the Company and its workmen."

As to the hostile attitude taken up by Trade Unionists generally towards profit-sharing, which Mr. Lever regards as an argument against the system, Mr. Livesey remarks that he can quite understand that hostility; but it is really an argument in favour of profit-sharing. "Where a profit-sharing system is in successful operation, based as it must be on mutual confidence, and resulting in the mutual advantage of employer and employed, there is but little, if any, necessity for the present-day Trade Union; and membership is thus likely to fall off. Industrial salvation will not come through the Trade Unions. Where a profit-sharing system is in successful operation, the rate of wages will almost certainly be at current market rates—possibly rather above, for there is not any reason why it should be lower. The men take more interest in their work, and therefore the employer can afford to give higher wages. It was the two profit-sharing Gas Companies, and not the Gas Workers' Union, that increased the stokers' wages in 1899, when they found that the law of supply and demand required the increase."

Mr. Livesey explains the system of profit-sharing in force at the South Metropolitan Company's works, and also shows what the system has done for the men. We note, with interest and satisfaction, that the proportion of withdrawable bonus invested or left on deposit with the Company, which a couple of years since did not, in the case of the men, exceed 50 per cent., has now reached to close upon 90 per cent.—a result not obtained without a certain amount of trouble, which has, however, "been well and amply repaid." As to the question of payment of bonuses in cash or otherwise, Mr. Livesey says: "Profit-sharing necessarily varies in methods of adaptation to the circumstances of the various businesses to which it may be applied. In cases such as ours, I believe the payment of the annual bonus in cash would do much more harm than good, and would sooner or later be fatal to the system; but I admit that there may be cases where it may be advisable to pay in cash—such cases, for instance, as those where the employees are constantly changing. In all cases, however, I earnestly advise that all possible inducements to thrift should be adopted."

Finally, referring to Mr. Lever's remark that something must be done, Mr. Livesey says: "Here I am in thorough accord with him. He is doing his part in his own way, in which everyone who has the welfare of the working-classes and of British industry at heart must heartily wish him success. Time only can prove which course is the best. No system is perfect; but by attempting to do what we can we shall gain experience, and thus make the way clearer for others. I conclude by repeating my conviction that the goal is partnership, the more complete the better, and that the only way I can see for its attainment is by means of profit-sharing." We will only add that those who are interested in the question, and desire to have by them an admirably concise statement of Mr. Livesey's arguments in favour of his system, cannot do better than possess themselves of the copy of the "Economic Review" from which the foregoing quotations are made.

GAS ACTS FOR 1901.

(*Concluded from p. 961.*)

THE Shrewsbury Gas Act converts the ordinary stock of the Company into a new 5 per cent. stock, with power to add £80,000, any portion of which may be issued as 4 per cent. preference capital. The proportion of loan capital is £26,666 in respect of the converted stock of £98,235; and one-third of the new issues. The sliding-scale is applied, with a neutral zone between 2s. 11d. and 3s. 4d., after which the dividend is to alter by ¼ per cent. for a penny. The price of gas charged outside the borough is not to be more than 6d. in excess of the current price within the borough. The Corporation may promote a purchase Bill in the next or following session of Parliament. The purchase is to be as by compulsion, and officers and servants of the Company are protected.

The South Metropolitan Gas Act enables the Company to raise £1,500,000 of new capital, to form part of the ordinary 4 per cent. stock sanctioned in 1900. Stock issues may be offered to gas consumers and employees of the Company, before being put up for sale by auction or tender, at as nearly as possible the average market price of the previous month. To ascertain the average market price of stock, the mean daily prices recorded in the Official London Stock Exchange List is to be taken for the four last completed weeks. Power is given to purchase the portion of the undertaking of the Gaslight and Coke Company which lies on the south side of the Thames for such price as may be agreed on between the Companies, provided that no such agreement shall have effect unless the Gaslight and Coke Company shall have obtained in the ensuing session of Parliament powers to raise additional capital; and also that the application of the purchase money is defined by such Act. In the event of the purchase not being effected, the amount of ordinary stock to be raised by the Company is to be reduced by £750,000.

The Stroud Gas Act converts the existing capital of the Company into a consolidated 5 per cent. stock, with £51,000 additional. The borrowing powers in respect to the new issues are in the proportion of one-third. New gas lands are sanctioned. The carry-forward on revenue account is limited to £5000 in any year. The price of gas fixed by the Act of 1864 is reduced to 4s. 6d. per 1000 cubic feet for 14-candle gas, tested on the works. No forfeiture is to be incurred for defects of supply attributable to unavoidable cause or accident. An additional, but not statutory, testing-place is to be provided at the District Council offices. Pipes may be laid by consent for ancillary purposes. If any road is broken up by the Company, it is to be repaired to the satisfaction of the County Council or the District Council maintaining such road (as the case may be); these rights and obligations are to be in addition to, and not in substitution of, the provisions of the Act of 1847.

The Weston-Super-Mare Gas Act authorizes the acquisition of additional gas lands. The existing capital is consolidated upon a 5 per cent. basis, with the addition of £36,000, and one-fourth loan capital. Gas of 15-candle power is to be supplied at the maximum price of 4s. per 1000 cubic feet. A statutory testing-place may be provided by the Urban District Council, at their own cost, at the Town Hall. Consumers' fittings may be specified. No

penalties for defective supply are to be incurred in the case of unavoidable cause or accident, or of slight and immaterial defects. The District Council may promote a purchase Bill within five years, on the usual terms for compulsory sale. A map of the gas-mains is to be deposited at the Town Hall within six months.

The Bingley Urban District Council Act authorizes the District Council to purchase the undertaking of the Cullingworth Gas Company, Limited. The sale is to be carried out within six months after the passing of the Act, under the provisions of the Lands Clauses Act relating to the settlement of questions of disputed compensation. The undertaking to be transferred does not include the cash balances (other than consumers' deposits) in the hands of the Company or their bankers on the day of transfer, nor the sums standing to the credit of the reserve fund, the stocks in trade, and stores. There are also excluded all rents and profits of, and all book and other debts due to, the Company, and all rates accrued due on the day of the transfer; and all books and papers relating exclusively to the shareholders and the constitution of the Company. All the expenses of the transfer and the winding-up are also to be paid by the District Council. All officers and servants of the Company, but not including the Directors or ordinary workmen, are to be compensated for any loss of office or emolument consequent upon the transfer. The limits of supply by the Council are extended to the whole of the district, with the exception of the portion lying within the limits of the Clayton, Allerton, and Thornton Gas Company. The purchased undertaking becomes part of the gas undertaking of the Council, and is subject to the same regulations, with a maximum price of 4s. per 1000 cubic feet. The amount of the purchase price is to be borrowed and repaid in forty years. Surplus gas profits are to go to the district fund.

The Bradford Corporation Act authorizes the Corporation to acquire additional gas lands, and to borrow £150,000 for gas-works purposes, repayable in forty years.

The Bury Corporation Act enables the Corporation to appropriate certain lands for gas-works purposes, and to borrow £51,000 for the same, repayable in thirty years.

The Colwyn Bay and Colwyn Urban District Gas Act provides for the transfer of the Gas Company's undertaking to the District Council. The Company were incorporated in 1896. The undertaking is defined as in the Bingley Act. The Conway District Council may purchase their portion of the undertaking at any time, on giving six months' notice to the Colwyn authority. The Act must be put in force within three months. The Secretary of the Company is protected. The maximum price of 15-candle gas is fixed at 5s. per 1000 cubic feet. Discounts of 10 per cent. are allowable to consumers. The capital is to be paid off in forty years, with a year's grace at the commencement. Surplus gas profits are to be carried to the district fund.

The Devonport Corporation (Gas) Act authorizes the Corporation to purchase the undertaking of the Devonport Gas and Coke Company within six months. In ascertaining the amount of the purchase price, the maximum authorized dividends are to be deemed to be the dividends which the Company paid to their shareholders in the year ended May 31, 1900; back-dividends to be excluded. The existing reserve fund remains the property of the Company; but the Company are to pay out of it all their own expenses in regard to the recent application to Quarter Sessions, the costs of their own Bill in the past session, and also of their opposition to the Corporation Bill. The Corporation are to pay the present Chairman and Managing-Director of the Company a life annuity of £150. The Secretary and Manager are to be compensated for any loss sustained through the transfer. Gas of 15-candle power is to be supplied at the maximum price of 4s. per 1000 cubic feet. Consumers' fittings may be specified. Government lighting contracts are to be priced 15 per cent. less than private consumers' rates. The sum of £100,000 is to be borrowed for gas-works purposes, in addition to the price of the property. Surplus gas profits are to go to the district fund.

The Honley Urban District Council (Gas) Act transfers to the District Council the undertaking of the Honley Gas Company, Limited. The price of the property is £18,500, which is to be paid within three months. Out of this money, the Company are to pay such costs of the transfer as are not paid by the Council; to repay any mortgage debt; and to distribute the remainder among the shareholders. The area of supply includes the district of the Council, and so much of the parish of Thurstonland, in the West Riding, as is not included in the limits of the Kirkburton Gaslight Company, Limited. The maximum price of 15-candle gas is 4s. 4d. per 1000 cubic feet. No penalty is to be incurred for deficient supply due to circumstances beyond the control of the Company, or of slight and unimportant character. Consumers' fittings may be specified. The capital loan is repayable in thirty years. Surplus gas profits go to the district fund.

The Mansfield Corporation Act contains a part sanctioning an agreement with the Mansfield Woodhouse Gaslight and Coke Company, Limited, for the purchase of their undertaking by the Corporation. The agreement forms a schedule to the Act. Additional gas lands are to be acquired. Consumers' fittings may be specified. The sum of £30,000, repayable in forty years, is to be borrowed for gas-works purposes. Surplus gas profits are to go to the district fund.

The Poulton-le-Fylde Gas Act provides for the transfer of the undertaking of the Poulton-le-Fylde Gas, Coal, Lime, and Coke Company, Limited, to the Urban District Council. The purchase price is to include a sum representing the capital expenditure of the Company, together with an additional amount to be agreed upon or determined by arbitration, and all the usual costs. The officers and servants of the Company are to be compensated. Consumers' fittings may be specified. The maximum price of 16-candle gas is 4s. 4d. per 1000 cubic feet. Improvement capital to the amount of £5000 is required, repayable in forty years.

The Smethwick Corporation Act authorizes the Corporation to borrow £89,000 for gas-works purposes, repayable in forty years.

The Wallasey Improvement Act contains a part authorizing the construction of a railway to the gas-works, to be completed within three years, at a cost of £4500. In addition, the Council are empowered to borrow £45,500 for gas-works purposes, to be repayable within thirty-five years.

The Winsford Urban District (Gas Transfer) Act confirms an agreement for the transfer of the local gas undertaking, the property of a Company in liquidation, for the sum of £15,862 awarded by Mr. Thomas Newbigging as sole arbitrator. Gas of 15-candle power is to be supplied, at the maximum price of 5s. per 1000 cubic feet. Consumers' fiittings may be specified. In addition to the amount of the purchase price, the Council are authorized to borrow £2000 for improvement purposes, and £1000 for working capital. Surplus gas profits are to go to the district fund.

SOUTH STAFFORDSHIRE MOND GAS (POWER AND HEATING) COMPANY'S ACT.

This Act falls to be epitomized here, inasmuch as it is a Gas Company's Act, although not of the ordinary class. It incorporates a Company for the manufacture and supply within parts of South Staffordshire and East Worcestershire of the producer gas commonly known as Mond gas, and of any development of Mond gas approved by the Board of Trade, and of any other producer gas so approved for the purposes of motive power and heating, but not of illumination. It is provided that, notwithstanding anything contained in the Companies Clauses Consolidation Act, 1845, a director of the Company may be interested or concerned in any contract with the Company, and may participate in the profits of any work done for the Company in all respects as if he were not a director. In order to have the benefit of this proviso, a director must disclose his interest to his co-directors, and not vote in respect of any such contract in which he is interested.

The objects of the Company, besides the selling of producer gas, comprise the manufacture of and dealing in residuals, and the erection and maintenance of producers, engines, and plant of every description. The capital is £1,000,000, whereof £100,000 is to be subscribed before the compulsory powers for the taking of land are put into force. The borrowing powers are in the proportion of one-third of the stock issued. The first ordinary meeting of the Company is to be held within six months of the passing of the Act; and it is not obligatory on the Company to hold more than one ordinary meeting a year. The necessary lands are to be acquired compulsorily within three years. Clause 25 empowers the Company to lay mains in any street within the district. They may require any other users of the subsoil to produce any plan of their sewers or mains in their possession, and take copies thereof. A month's notice of the intention to do any main-laying work in the public streets is to be given by the Company to the local authority—no part of the month of August being included in such period of notice. Roads not repairable by the local authority are to be dealt with after due notice to the owners. Local authorities or owners may themselves exercise the powers of the Act in respect to the breaking up and reinstatement of roads. A new statutory term—that of "operators"—is here employed, in order to distinguish the parties to these proceedings; and the mutual rights and responsibilities of operators and owners of the roads, sewers, mains, &c., are set out in several pages of the Act. For the further protection of the local authorities, it is provided that the Company's mains are not to be laid, without consent, on the surface of the ground nor under the footpaths. General powers of supervision are given to the local authorities, who are to be recouped for the expense of such supervision. Not more than 100 yards of street are to be broken up at once, and consecutive openings are to be at quarter-mile intervals. Only one-half of a street is to be blocked at a time. All mains and services are to be buried to a clear depth of 2 ft. 6 in. Any extra traffic thrown upon main roads by the Company's operations is to be paid for. The Company are not to have any claim for damage done by steam-rollers to pipes laid a less depth than 2 ft. 6 in., measured to the top of the pipe, in any main road.

The Corporation of West Bromwich have a number of protecting clauses, among others one enabling them to purchase the mains in the event of the Company becoming insolvent, or to remove them at the Company's expense. Most of the other local authorities of the district have their own protecting clauses, many of them of great severity, which are too long to reproduce here. By clause 46, the Company are required to supply gas on demand to any premises within 100 yards of a main, supplying 30 feet of

the necessary service-pipe. Applicants, if required, are to enter into a written contract with the Company to take not less than one million cubic feet of gas per quarter, and to continue taking it for a period of two years. It is further provided that the Company shall not supply any person with gas unless such person is willing to contract for a supply of not less than one million cubic feet in a year; nor shall the Company supply gas for use in private dwelling houses. Supplies may be by proportional meter, instead of by a meter within the meaning of the Sale of Gas Act, 1859. "A proportional meter means a meter which measures and records a fraction of the total quantity passing through the meter." Gas is not to be supplied or used for purposes of illumination. If any customer of the Company shall use the gas for the purpose of illumination, the Company are to cut off the supply immediately upon becoming aware of what is going on. Breaches of these provisions by the Company are punishable by a penalty of £20 and a daily fine of £5, recoverable by the owners of the gas undertaking of the district.

The charges for the Company's gas are to be such as may be agreed upon, not exceeding 3d. per 1000 cubic feet for quantities over 4 million cubic feet per quarter, and 4d. per 1000 cubic feet for any smaller consumptions. Provided that if at any time it be proved to the satisfaction of the Board of Trade that the price of "good quality slack" exceeds 6s. per ton delivered at the works of the Company, then the Board of Trade may authorize an increase of price by one-eighth of a penny per 1000 cubic feet for every shilling per ton, or by such other proportionate amount as the Board of Trade may determine. The Board of Trade, in order to ascertain the price of "good quality slack," may institute such inquiries as they may see fit, at the Company's expense. Revision of prices may take place every ten years. It is not lawful for the Company to supply gas containing more than 14 per cent. of carbonic oxide, or which does not possess a distinctive and readily perceptible smell. At every generating station, the Company are to keep a testing-place, with apparatus for ascertaining the thermal power of the gas supplied and the proportion of carbonic oxide. Gas examiners may be appointed by local authorities or the justices. If it is proved to the satisfaction of two justices, not being shareholders, that the gas is of "less thermal power than it ought to be according to the provisions of this Act," the Company are to forfeit £20 a day. The minimum heating value of the gas is to be 125 B.T.U. per cubic foot.

If the profits of the Company in any year amount to more than sufficient to pay a 10 per cent. dividend, the surplus is to be equally divided between a reserve fund and in reduction of the prices of gas. The amount of the reserve is not to exceed £100,000. The Company are given two years from January 1, 1902, to substantially commence their works for the purpose of carrying out their powers under the Act, and four years to make the supply effective, in default of which the powers of the Act are to lapse. Special provisions in this respect apply to the Corporation of Walsall. The Company are answerable for all accidents, damages, and injuries done by or through their contractors or servants. The Act is not to confer any monopoly on the Company. A schedule sets out the amount of the consideration payable to Dr. Ludwig Mond for his patent licences.

ELECTRIC LIGHTING MEMORANDA.

A Wiring Dispute at Finchley—Electric Lighting on a Commercial Footing—The Law of Overhead Wires—The Advantages of Overhead Wires.

A curious case of militant Municipalism recently came before the Lord Chief Justice, sitting as Vacation Judge. Application was made by the Finchley Electric Light Company, Limited, against the Finchley Urban District Council, asking that the defendants might be restrained from interfering with their overhead wires. It appears that the Company do an electric lighting business in Finchley without statutory powers. Some months ago, the District Council took proceedings against the Company to prevent them breaking up the streets (for the purpose of laying mains) without the consent of the Council; and the Company therefore undertook not to break up any roads in the district without applying for the Council's permission. All further proceedings in that action were therefore stayed. But the Council refused permission to open a particular road, and consequently, for the purpose of carrying on their business, the Company carried an overhead wire across the road from a pole already erected on private property on one side of the road, to a point on private premises on the other side. Three days later, the Surveyor of the District Council had this wire cut; and these legal proceedings followed. The Company's Counsel told the Court that he wanted the cut wire restored, and the District Council ordered not to interfere with the wires again. He admitted that his clients had no power to open the roads, but contended that, so long as they complied with the Board of Trade regulations, they could cross the roads by means of their overhead wires. The question of conformity to the regulations relating to overhead wires is for the Board of Trade, not the Local Authority.

There is a sporting element in this Electric Light Company's operations which engages one's sympathies. Electric light companies who are in the business for its own sake, and are prepared to keep their standing against the local authority, are so few that the temerity of those that actually brave the hazards of the trade and the hostility of the authorities is entitled to hearty respect. We wish there were more of them. Such trade rivals would do sleepy gas directors a world of good. A real live trading electric lighting company, not a mere official undertaking of a local authority maintained out of the rates, would put gas people on their mettle. The Lord Chief Justice evidently felt for the Finchley Electric Light Company; for he inquired of the Counsel for the District Council what was their justification for cutting the wire. This question got home upon the defendants, who could only urge that they acted "upon behalf of the public." They had previously argued that "a person without statutory powers cannot be in a better position than one who has them." This was only another way of saying that the supply of electricity for lighting purposes by means of overhead wires is preferable, from the point of view of the undertakers, to the obligation to put them underground. But freedom from statutory obligations has other commercial advantages. It enables a trader to pick and choose his customers, and charge them any prices that may be agreed upon. There are no penalties; no requirement to publish accounts; no more subservience to the local authority, as such, than weighs upon the butcher and the baker.

It seems to have struck the Finchley Urban District Council that this is a perilous state of affairs, which it was their urgent duty to put a stop to, by the simple expedient of cutting the Company's wires where they crossed the public road. They rested on the plea that the Company were "trying to establish a right." But it does not seem to have occurred to them either that they had no right to touch the Company's property in question, or that their own position is not free from complications. As a matter of fact, the District Council have an Electric Lighting Order of their own, granted in 1897, which they have not taken any steps to carry into effect. Their wire-cutting performance, therefore, might be aspersed as an act of trade jealousy; and as such it was carefully described to the Judge. He does not seem, however, to have taken the point. It was superfluous, because the law of the subject was quite clear. A highway authority do not own the freehold of the roads over which they exercise jurisdiction. Their powers do not extend above or below the actual surface of the road which is used for traffic, and they have no right to touch either the pipes below, or the wires above, the surface. It might have been thought that there is plenty of information available on this point; but arrogant local authorities take a deal of teaching against their will. The Finchley Urban District Council are the latest, if they will not be the last, to receive another lesson on this point of law; for the Lord Chief Justice granted an injunction in the terms of the motion.

Meanwhile, the attention of persons who engage in electric lighting for profit, as an ordinary speculative business, is being directed more and more to the practical advantages of distribution by means of overhead wires. These wires are not in themselves illegal; but so much objection was taken to them twenty years ago, that the Electric Lighting Acts constructively require statutory electric distribution to be by underground wires. At that period, electric tramway working was unheard of. No sooner had all the electric lighting wires been put underground, than the electric tramways came along and festooned the highways with their more dangerous aerial conductors. It was a case of compulsion. "No trolley-wire no tramway" was the transportation electrician's formula; and it was so. Now it is beginning to strike the lighting electricians as ridiculous that they should be condemned to use underground cables while the tramway branch are encouraged to avail themselves of overhead wires. There would be no difficulty whatever in running a lighting wire along the tramway standards, and this will probably be done in an increasing number of instances. The electric power distribution interest, also, is clamouring for the same relief. Why should the power transmission wires through a barren countryside be carefully buried, while the moment the district becomes populous, live overhead trolley-wires appear? It does look inconsistent; but there is another side to the question. Says the "Electrician" of Oct. 11: "Every storm such as that of Sunday does damage to numbers of land-lines, and causes congestion of the telegraphic and telephonic traffic all over the country." What in this case, is mere annoyance would be danger in the case of some wires. The warning of Liverpool is not to be so quickly forgotten.

We learn that, at the request of the Borough Council, Mr. E. Boulnois, M.P., Chairman of the West Middlesex Water Company and of the Staines Reservoirs Joint Committee, has waived his objections to being nominated for the mayoralty of Marylebone for the ensuing year.

In a recent number of the "Journal of the American Chemical Society," Messrs. W. A. Withers and G. S. Fraps dealt with the subject of the rate of nitrification of some fertilizers. Their experiments led to the following (among other) conclusions: 1. When ammonium sulphate is used as a fertilizer, in most cases it would be advisable to add calcium carbonate in some form also. 2. The low rate of nitrification of ammonium sulphate is probably due to the presence of organisms which nitrify organic compounds in preference to ammonium salts. The presence of the ammonium sulphate may also hinder the activity of the nitrifying organisms. The acids formed may also be a hindrance when no base is present to neutralize them. All three of these causes may be in operation at the same time.

BEFORE AND BEHIND THE INCLINED SETTINGS AT LOWER SYDENHAM.

When Mr. S. Y. Shoubridge appeared at the Belfast meeting of the Gas Institute with his paper on "Inclined Retorts at Salford," it was at once recognized in the gas profession that in him the growing system of carbonization by means of sloping retorts would have a staunch and persuasive advocate; and so he has proved to be. Mr. Shoubridge was responsible for the Salford installation; but before he read the paper referred to, he had migrated, as most readers will be aware, from Salford to the Crystal Palace District Gas Company, where he soon commenced to put into swing those professional tenets which had received the proof of his own practice, or which had been accepted by him after the exercise of his natural penchant for inquiry. Among other things, he found that one of the retort-houses at Sydenham required a new equipment; and he determined, with the consent of his Board, that the success of the Salford inclined installation should be repeated in his new field of operation. The situation of the house in question is not an ideal one for the engineer who desires to achieve the utmost economy in carbonization; but Mr. Shoubridge was so convinced as to the ability of inclined retorts to effect economy even under the adverse conditions with which he was faced, that he did not hesitate to recommend his Directors accordingly. The installation was made entirely by the Company's men—even the roof of the house, as well as the ordinary bricks and stone used in the building being made on the works; and it has been in operation now for something like four months. Simplicity is the dominating feature of the Crystal Palace inclines; and therefore it was not astonishing to find their designer handling somewhat severely, at the Glasgow Engineering Congress, the project of Mr. W. R. Herring to add to the Granton installation of inclines mechanical appliances for assisting in their discharging. As we understand Mr. Herring's critic, inclined retorts which are not within an ace of being automatic in their charging, and entirely so in their discharging, are an unpardonable offence to the fundamental principle of the system, and the violation of that principle will be detrimental to advance. In other words, he contends that progress must be in the direction of simplicity; not in that of complexity.

Mr. Shoubridge is not given to postulating; and so, during his criticism, a determination was made to go and see what he was actually doing with the inclines at Sydenham, and, with permission, to place on record what was observed. "Seeing's believing" is a pithy schoolboy maxim which clings to one in after-life, and, if not then often used, is frequently felt. Accordingly, we presented ourselves at the Sydenham works a few days since, and Mr. Shoubridge kindly consented to a thorough inspection of his installation. What was then seen we shall write in our own manner, and without suggestion or restriction on the part of Mr. Shoubridge as to what should or should not be said. If, however, anyone doubts the account, then all we can say is let him journey to Sydenham, and see for himself.

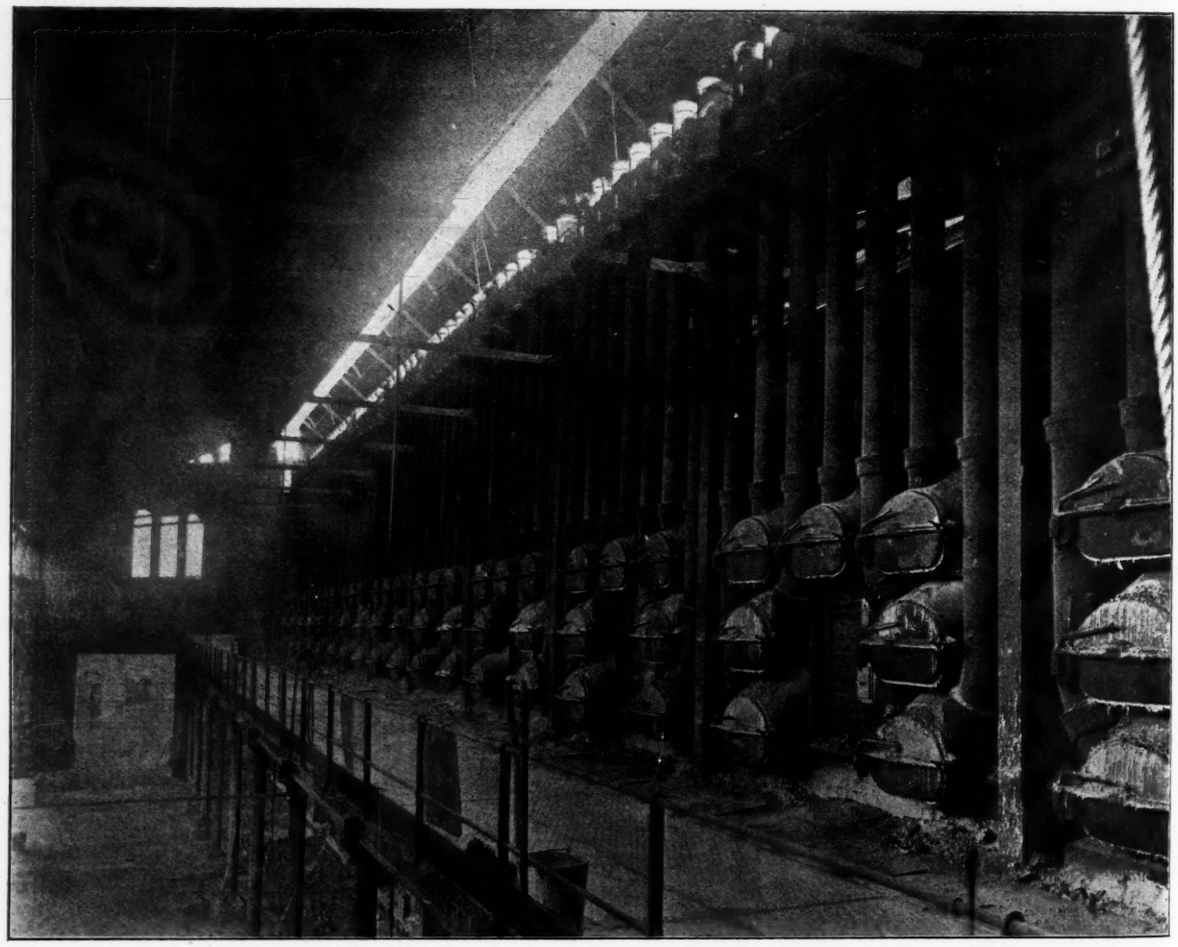
By good fortune, the visit was well timed; and a short wait brought us to the ordinary hour for discharging and re-charging the retorts. While the operation was proceeding (without any more interference with the men's usual course of working than was necessary for an examination of the charges and heats), liberty was given to witness the work from any point; and of that full advantage was taken. On the charging-floor, on the stage floor, and on the ground level, the discharging of the retorts was carefully watched, with the result that we can safely commit ourselves to the definite statement that there was not a single case in which any initial persuasion was necessary to induce the exhausted charges to flow freely out. Mr. Shoubridge's pride in his retorts kept the spectator captive during the discharging of the bench from one end to the other; the bench consisting of ten beds of sevens. On opening the lids, the men simply brushed out the film of tar which had collected on the mouthpieces, next lifted out the stoppers, and then—well some little agility had to be displayed by the attendants to get without the "torrid zone" of those incandescent masses of coke which came sliding out with a clean sweep, and left exposed to view the clear surfaces of retorts, white-heated from entrance to exit. The first retort—the bottom one next the outside wall of the bench—was the only one that showed a little hesitation in parting company with its burden. But, in a few seconds, out came the first pieces of the charge, and the remainder quickly followed. The whole of the other retorts—bottom, middle, and upper—throughout the ten beds were relieved of their spent charges, without the slightest prompting, with a uniformity of rapidity and freedom which was good to behold.

The want of uniformity in some installations has been to us one of the mysteries of the inclined system. Retorts charged with coal from the same hoppers, by the same charging apparatus,

operated by the same men, and situated in the same setting, have been found to emit the spent charges with a variableness which causes wonder. While some are active, others are but splendid examples of extreme sluggishness. Then why should the seventy Crystal Palace retorts work with the consistency of smartness which we have described? While before the retorts, we turned to Mr. Shoubridge for an explanation. His reply was to the effect: "There is no mystery at all about it. With retorts of a proper section and tapered, properly heated, charged, and burnt off, any inclined retorts (assuming, of course, they are properly set) will discharge themselves as readily as those you have just seen." The Crystal Palace retorts (which are set at an angle of 32°) taper outwardly. They are 21 in. by 16 in. at the charging end, and 24 in. by 16 in. at the bottom, and are 20 feet in length. They are of ⏢ shape; but instead of the sides being vertical, they incline outwards from the bottom to the arched top. The advantage of this section is that, as the coal swells, there is room for it to expand; and it does not get wedged on to the sides. This, coupled with the tapering of the retorts, which relieves the charge of any side pressure, is one of the secrets of the good working at Sydenham.

As to the second condition for satisfactory work—the proper heating. As everybody knows, the heating of inclined beds evenly in every part has been one of the troublesome points in the past. Now, one of the charms of this Sydenham installation is the equal heating of the settings throughout. On the occasion of our visit, the burnt-off charges, when exposed to view, presented no variation in appearance from top to bottom; and one spent charge in any part of the bench was merely the counterpart of another in any other part. What is said of the charges, is all that can be said of the retorts—in whatever position they were located, there was no apparent distinction in their heating as between one and the other and throughout their lengths. The settings are heated by a simple type of regenerator furnace. The sight-holes to the combustion-chambers all along the bench were consulted; and there again the quality of the temperature was manifest. The sight-hole to the main flue was referred to, and we were satisfied that there was no visible heat going to the chimney. All this may seem extravagant, but it is precisely the state of the settings as we found them. Under such circumstances, the fourth condition could not fail to be realized.

There is yet the third condition to be dealt with; and that is the proper charging of the retorts. Failures in inclined settings have in many instances been due to irregular charging. The method of charging which Mr. Shoubridge has in use is of his own devising; and it is almost identical with the arrangement



described in his paper on the Salford installation. When he first went into the question, he found that, in many of the then existing installations, the coal was being dropped into the three tiers of retorts from one level—from the mouth of the measuring chamber above; and it struck him at once that, if the drop was right for the top retorts, then it could not be right for the bottom ones, because of the extra difference of 4 or 5 feet in the height. With such a considerable difference, the charge to the bottom retorts must get too much impetus, and result in frequent choking at the lower ends. With this in view, Mr. Shoubridge invented a charger which gives him a *uniform fall to each tier of retorts*. This is secured by having three separate compartments—one for each horizontal line. By simple arrangements, the measurement of the charge and the regulation of its flow are performed with a certainty which assures uniformity throughout the settings. We have not described the charger to any length, as a general idea of its construction will be gathered by referring to the paper on the Salford installation.* However, the longer Mr. Shoubridge's experience of his charging arrangement extends, the more convinced he becomes that, by its use, he can deal effectively with any class of coal, fine or large, and can secure an even layer throughout the length of a retort, whatever its position. The charger runs on overhead rails, and is propelled with the utmost ease by the men by means of bevel gearing attached to the travelling-wheels. It is fed from three overhead double compartment hoppers, each of a capacity of 15 tons, or a total of 45 tons. The hoppers are supplied from the coal-breaker outside by means of an elevator and a De Brouwer conveyor. (Parenthetically, readers may be reminded that Mr. Shoubridge was the first in this country to adopt the De Brouwer conveyor.) At the time of our visit, charges of 6½ cwt. were being made; and the coal used was from Derbyshire. Top, middle, and lower retorts in different parts of the bench were charged in our presence; and from end to end and side to side, the layers rested as evenly as though they had been carefully placed there by hand, and without anything flowing over the stopper. This evenness, the spent charges we had previously seen proved, is maintained throughout the process of carbonization.

This is the story that has to be told as the result of our visit. From it, it will have been gleaned—and we only repeat the points for the purpose of emphasizing them—that the uniformity of working and the automatic action of these inclined retorts are

* See "JOURNAL," Vol. LXXII., p. 31.

secured by equality in the heating, proper charging, thoroughness of carbonization, and the use of tapered retorts of the section described.

Apart from the settings, there are a few other points which make this retort-house interesting. In its conversion from the horizontal to the inclined system, Mr. Shoubridge adapted the building to the new circumstances on the most economical lines; and it answers well. Instead of carrying the whole roof up to the full height required for the inclined system, he simply ran a light roof from the front outside wall to the buckstaves of the bench, and then constructed an elevated covering of corrugated iron for the storage hoppers and conveyors on the charging side of the house. This reduced the cost of the roof work very considerably; and so far as we know, this is the only instance in this country of an existing house being converted to the inclined system in such a simple and inexpensive manner. The only structural alteration to the shell of the house was that the outer walls were slightly lengthened at one end in order to get in an additional bed. Of course, the house is not exactly what Mr. Shoubridge would like to have if he were starting *de novo*. But he laid his plans here with the sole view of saving unnecessary expenditure.

Then, again, the situation of the house is not by any means one which will permit of the utmost economy being realized in the working of the system. One end of the house almost abuts on a public roadway; and at the other end, it is close upon the main road through the works. Coke-conveyors were therefore out of the question; and the coke has all to be shot into barrows, and removed by hand. The time occupied in charging has therefore to comply with the time consumed in wheeling out the coke. Then there are not sufficient beds in line to secure the maximum economy in respect of the labour employed. In each shift there are two men on the charging-floor, two on the stage, and two for wheeling out and quenching the coke; and, under present conditions, these men have plenty of spare time hanging on their hands—quite sufficient, in fact, to easily deal with a further five or six beds, without additional expense in the shape of wages. Therefore it would not be fair to place the figures Mr. Shoubridge has given us in comparison with those from other works, where the inclined system is operating under the conditions requisite to attaining the highest economy. Herein is to be found one of the mistakes that is frequently made. Engineers do not always, in making comparisons, consider what a fellow engineer has, and do not recognise that what he has is perhaps not what he would like. We must ask for this recognition for the subjoined figures, which apply to the working of the house under the old horizontal system and under the disadvantageous conditions of the new. Nor, again, must these figures be placed in comparison with machine stoking, unless this is carried on under counterbalancing adverse circumstances.

COST OF WORKING No. 1 RETORT-HOUSE.

INCLINED RETORTS.

Ten Beds of Seven Retorts = 70 Retorts.

2 Charging men per shift × 3 shifts = (These men also attend to engine and elevator.)	6 at 6s.		£1	16	0
2 Emptying men × 3 ,,	6 ,, 6s.		1	16	0
2 Cokemen × 3 ,,	6 ,, 5s. 3d.		1	11	6
2 Firemen × 2 ,,	4 ,, 5s. 10d.		1	3	4
1 Coal unloader × 2 ,,	2				
Unload 91 tons per 24 hours (piecework) per ton		2¼d.		17	1
Oil, waste, &c., per 24 hours. . . .				1	8
Total men	24				
Wages for carbonizing 91 tons of coal			£7	5	7
Wages per ton = 1s. 7·2d.					

COST OF WORKING HORIZONTAL RETORTS BY HAND.

Ten Beds of Seven Retorts = 70 Retorts.

2 Scoop drivers per shift × 3 shifts = per 24 hrs.	6 at 6s. 3d.	£1	17	6
2 Stokers ,, ,, × 3 ,, ,,	6 ,, 6s.	1	16	0
2 ,, ,, ,, × 3 ,, ,,	6 ,, 4s.	1	4	0
2 Barrow men ,, ,, × 3 ,, ,,	6 ,, 5s. 3d.	1	11	6
2 ,, ,, ,, × 3 ,, ,,	6 ,, 3s. 6d.	1	1	0
1 ,, ,, ,, × 3 ,, ,,	3 ,, 7s.	1	1	0
2½ Firemen ,, ,, × 2 ,, ,,	5 ,, 7s.	1	15	0
3 Coalwheelers ,, ,, × 1 ,, ,, (Piecework) 80 tons at 3¼d.	3	1	3	4
Total men	41	£11	9	4
Cost per ton, 2s. 10·4d.				
Saving by inclined retorts, 1s.3·2d.per 24 hrs.	17 ,,	£4	3	9

It is hoped that readers will derive from this account of our visit to the inclined retorts at Sydenham some of the interest which was experienced during the hour or two spent in watching their operation.

The Institution of Mechanical Engineers have had a tremendous inflow of new members during this year. A long list was read by the Secretary (Mr. Edgar Worthington) at the meeting last Friday; and it evoked the remark from the President (Mr. W. H. Maw) that, in the course of the year, 449 members of all classes had been elected. This was an increase of 84, or 20 per cent., over the previous highest record for a year.

THE GAS AND WATER STOCK MARKET.

(For Stock and Share List, see p. 1051.)

THE sum-total of business transacted on the Stock Exchange last week reached only a very moderate figure. At no time was there any moving influence; and, in view of the Exchange being closed on Saturday, business practically dwindled away to next to nothing on Friday. In the more speculative departments, prices were rather variable; but the choice gilt-edged securities were firm, on the strength of the favourable reception accorded to some recent issues. In the Money Market, quotations ruled pretty good for the best part of the week; but, before the close, the abundant supply available caused an easier condition to supervene. In the Gas Market, business was at first much restricted, and things looked as if the week was going to be very bare; but later on a good batch of dealings in the stocks of the two leading Metropolitan Companies effected a revival. Changes in quotation were neither numerous nor considerable; but they were all in the upward direction, with one exception. This isolated example was Gaslight ordinary, which underwent a further reaction from the position of parity to which it had been elevated. It opened on Monday at 98, but never touched that figure again until the closing day, on which, with some apparent inconsistency, the quotation was lowered a point. The secured were dealt in to a very fair extent, and marked good prices; but the quotations could not quite manage to score an advance. Transactions in South Metropolitan were recorded at good middle figures, but without indication of a tendency to move either way. Nothing at all was marked in Commercials; and the figures were left stationary after the good buying recently effected. In the Suburban and Provincial group, business was on the whole very quiet, but further attention was directed to Tottenham and Edmonton, and the quotations were advanced. The Company are offering a small amount of "B" stock at par. Continental Companies were very quiet, but very firm; and the prices marked seemed good enough to warrant quoting higher figures. None of the rest made any show, but Hong-Kong, which advanced half a point. Transactions in Water were fairly numerous as things generally go in that quarter; and several further advances were scored—Grand Junction leading with a 6 per cent. rise.

The daily operations were: Very quiet business on Monday, but things began to rise at once. Tottenham "B" rose 3, Brentford debenture 1, and Hong-Kong ½. In Water, Lambeth 7½ per cent. gained 2, Southwark 1, and East London debenture 1, Tuesday also was quiet, and nothing moved. Wednesday was a shade more animated. Tottenham "A" and "B" advanced 2 each. Gas was more active on Thursday, but unchanged. In Water, Grand Junction rose 3, Chelsea 2. Friday was equally active. Gaslight ordinary fell 1. In Water, Lambeth advanced 1.

Dr. Thresh on "Water and Water Supplies."—We have received from the publishers of the above-named work (Rebman, Limited, of Shaftesbury Avenue, W.C.) a copy of the third edition, which has lately been issued. The book was first published in 1896; but the contents have since received several additions, and the whole has now been brought up to date. We shall take an early opportunity of noticing the book more fully.

The Rating of Moveable Machinery.—A point in rating has arisen in Norwich, where the valuers engaged to re-assess the city property have increased assessments by rating moveable machinery, which hitherto has not been rated. Nearly every trader and manufacturer in the city will be affected; and the burden, it is stated, will press most hardly upon small power users, who take current from the local Electricity Company to drive small plants. The procedure, it appears, is within the law; but out of thirty-six towns of which inquiry has been made, in one only has this principle been carried out in fixing assessments. The city manufacturers have raised a guarantee fund with which to prosecute an appeal.

A Relic of Slave Days in Gas-Works.—In the "JOURNAL" for the 23rd of July (p. 226), we gave some particulars, from a number of the "Times-Democrat" of New Orleans, which had been forwarded by an esteemed correspondent, in regard to the early history of the Gas Company in that city, when slave labour was employed in the works. There were some 62 slaves, but they were manumitted under the proclamation of the President in 1863. An interesting relic of these bygone days, taken from the archives of the old Company, has been forwarded to us by Mr. Fred. H. Shelton, the Engineer of the present Lighting Company. It is the form issued to the slaves to enable them to pass the City Police, and we reproduce it as nearly as possible:—

NEW ORLEANS GAS-WORKS,..... 186

..... *No.*.....

Boy.....

.....

The City Police will pass the slave boy .....

.....

Mr. Shelton remarks that "fortunately, in these days, gas companies need no longer use such a form as this, nor carry on their books and assets $40,000 of slaves, as the New Orleans Company did forty years ago."

COMMUNICATED ARTICLES.

THE CONSTRUCTION AND METHOD OF CHARGING INCLINED RETORTS.

By GILBERT LITTLE, M.Inst.Mech.E., of Smethwick.

In the controversy regarding the cost of the two distinct systems of charging inclined retorts, the advocates of both have overlooked the chief factor in the first cost of installing either the continuous coal-storage hopper with "shot-pouch" measuring chambers over each tier of retorts, and three lightly-constructed traversing shoots (fig. 1), or the centralized hopper with three single or one triple shoot forming combined chambers and shoots (fig. 2)—namely, the automatic machinery and the improved methods of production introduced by the manufacturers of machinery for inclined retorts. In the addresses of the Presidents of the numerous Gas-Managers Associations, and in papers contributed by members, we are supplied with figures galore, showing reductions varying from 4s. 6d. to 2s. 2d., and 3s. to 1s. 6d. in the cost for labour per ton of coal carbonized; but never is a particular given, or an observation made, regarding the multitudinous changes the manufacturing engineers and contractors for gas-plant have devised to cheapen the prices of the appliances that have brought about these large reductions in the cost of carbonizing.

As I made the elevator for the first inclined retorts in England, and have since manufactured and installed a very large percentage of the automatic appliances for the installations in England, on the Continent, and throughout our Colonies, perhaps you will not grudge me a couple of columns of space in the "JOURNAL," to put before gas-engineers (1) a few particulars relating to the improvements to reduce the cost and improve the quality of the machinery, and (2) to show that, as regards first cost and subsequent efficiency, the continuous storage hopper, with "shot-pouch" measuring chambers, is undoubtedly more automatic, and not more expensive, than the central storage hopper and the combination of traversing chamber and shoot.

First, the improvements made by the manufacturing engineer to cheapen the cost and improve the quality of the appliances. With regard to coal breakers, conveyors, and elevators, in his recent paper read at Glasgow, Mr. Herring stated that "these have been used for many years in gas-works, and they found them not only reliable, but the cost for renewals and repairs very small." In his recent address at Cambridge, Mr. R. Brown remarked that "coal-elevators and coal-conveyors are now about as perfect as engineering ingenuity can make them;" while a few days later, Mr. Matt. Dunn, at the meeting at Ripon, informed

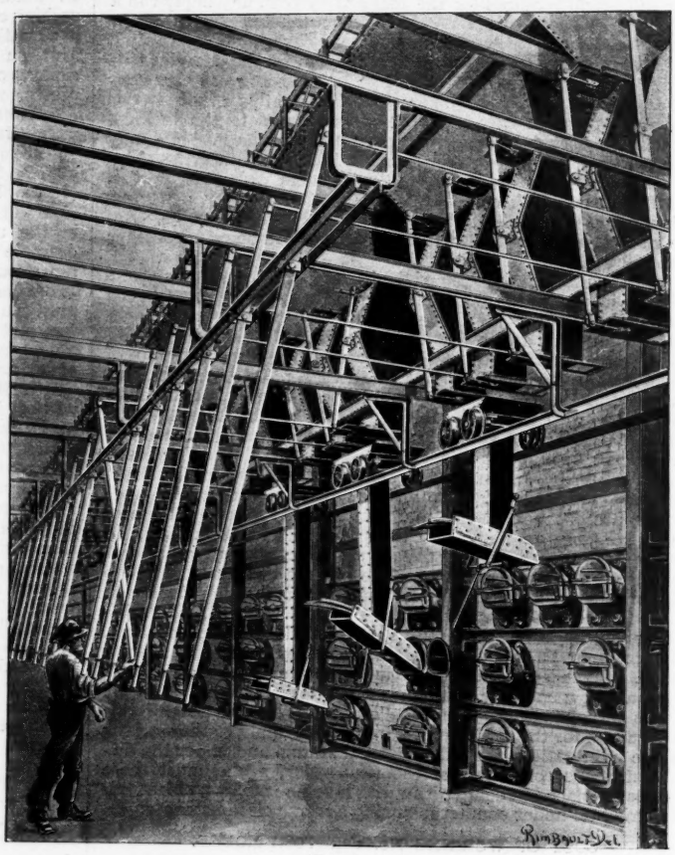


FIG. 1.

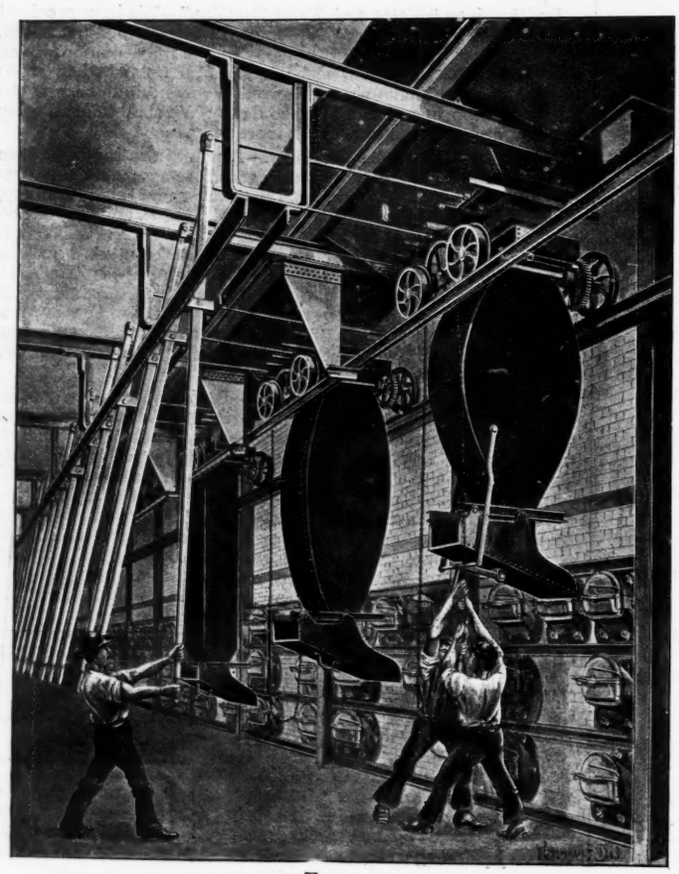


FIG. 2.

the North of England Gas Engineers that "further improvement in coal elevators and conveyors can only occur in the veriest details." With each of these emphatic pronouncements regarding the design and construction of elevators and conveyors, I heartily concur, and trust it will not be forgotten by users that the perfected tools and improved processes employed in the production of these labour-saving appliances will not make it difficult to preserve for the future the high reputation attained by the manufacturers. Equally improved facilities are at hand in the daily manufacture of the static, as I have shown are possessed for the cheap production of the dynamic, portion of the coal plants.

The storage hoppers and measuring chambers are constructed rapidly and cheaply by modern tools. One example as a contrast between the methods of manufacture in vogue six years ago and to-day, will serve to indicate the progress made all round. Recently we had 156 measuring chambers and storage hoppers, 540 feet long, to make for the Melbourne, Cambridge, and Königsberg Gas-Works. We obtained the steel plates necessary for their construction rolled and cut to the exact shapes and sizes required; and the 156 measuring chambers were all stamped at our works by a powerful hydraulic press in a few hours. The sides and the louvres of the storage hoppers were also stamped by the hydraulic press; and a vast reduction made in the cost of manufacture is not the only pleasing feature, but the much improved neat appearance and dust-tight construction of the measuring chambers and hoppers, presenting in these respects marked contrasts to the early "built" designs. Further improvements, therefore, in the static portion of the coal plant for inclined retorts can, as has been truly said of the dynamic appliances, "occur only in the veriest details."

I now pass to (2), to demonstrate that, as regards first cost and subsequent efficiency, the continuous storage hopper, with measuring chambers and short-pouch valves and levers, is undoubtedly more automatic, and not more expensive in structural cost, than the central hopper with the combined traversing receptacle for the charge, and also forming the shoot.

To enable readers to clearly see the difference of the two types I have prepared sketches of each (figs. 1 and 2). As Mr. Herring stated in his recent paper at Glasgow, with the continuous storage hopper, the coal is mechanically delivered over every retort at the exact point required; and by actuating the cut-offs of the shot-pouch measuring chamber, the charge therein glides through the shoot over the floor of the retort. With the other type (fig. 2), the coal is mechanically deposited in a hopper wherever it may be, the charge is dropped there from to the portable receptacle and shoot, and then hauled along by the men, as shown in the sketch. Having watched the "evolution and development" of appliances for charging inclined retorts since I supplied the elevator, twelve years ago, to lift the coal to the first and experimental bed of inclined retorts at Southall, I wish to be allowed to put it on record here, like Messrs. Husband, Herring, and the numerous other users of the system shown in fig. 1. I am satisfied no argument in the world will convince me that the work can be done as cheaply or efficiently by the unwieldy combination of chambers and shoots shown in fig. 2 as by the shot-pouch device, which determines the charge of coal and conducts it so simply through the light and easily moved shoot.

Coming to the question of the first cost of installing these respective methods, I agree with Mr. Herring that the less automatic (fig. 2) is not the cheaper, and is certainly not so economical in the cost for labour during the night and day operations to be performed. The bench of retorts must be provided with as much supporting ironwork; the upright buckstays are the same weight whether used only as stays to the brickwork or having to additionally carry the continuous storage hopper; and the cross joists, which are fixed at one end to the uprights and at the other are built into the wall of the retort-house, in my opinion strengthen the arrangement considerably. In our recent installations, all the buckstays on the back of the bench are alike—all holes being put in to one template; whereas on the one large hopper method, those which carry the hopper are heavier, longer, and have more work on them, than the buckstays that have not to support the hopper. It is not easy to get the large hoppers in many retort-houses of one size or shape, because few retort-houses are alike, the quantity of coal to be stored varies, and the position of the hopper in the house generally depends on the situation of the coal-store or the point at which the coal is dumped. In the last case, some additional elevators and conveyors may be necessary. These add complications, and increase the cost; also the cost of working. Now take the continuous hopper, and it is apparent, no matter what number of beds are built, no complications can ensue, as the section of hopper on every installation is precisely the same, and can be made any length without a drawing, as the workmen have become so familiar with the work that, knowing the number and centres of the beds, they can, by experience, mark off the holes and plate the continuous standard width hopper from memory—in fact, a few of the more resourceful could do so blindfold.

If we are twitted daily that the reason the Americans surpass us in many departments is due to repetition and standard work, why should the standardizing of the section of the hopper and the measuring chambers be made light of by a very few gas engineers? I am almost sure no firm of manufacturing engineers or contractors would submit tenders for the large hopper system, unless it was specially called for in the specification. Let us consider mere weight of metal in the respective hoppers. In all retort-houses so much weight of coal is wanted for a twenty-four hours supply; and taking as an instance an installation of ten beds of seven retorts each, 110 tons of storage is required. This necessitates a hopper 20 ft. by 20 ft. by 15 ft. deep. This hopper would not be easy to carry, and more difficult to strut. Again, if several localized hoppers are made, they are more expensive to construct than the continuous hoppers. During the last ten years, I have taken out the quantities and extended the cost, item by item, of dozens of arrangements similar to the less automatic system in fig. 2, and have done like work for hundreds, as shown on fig. 1; and I can assure Mr. Shoubridge that the cost of the better system is not the dearer.

In the light of these facts, let us be logical, and adopt the most automatic method. The history of invention comprises no department of work more interesting than that which touches upon automatic appliances; and among gas engineers it is abundantly evident that the characteristic most prominent is the adoption of labour-saving machinery. It may be said that the most brilliant achievements of mankind will only be made when his work is done by the aid of mechanism which operates with the definiteness and precision of an intelligent creature—doing its work without complaint, weariness, or irregularity. When we reach that stage of mechanics in gas-works, we will be able to discard even Copenhagen stokers afflicted with *ennui*.

ORIGINAL RESEARCH v. RUTS.

By W. H. Sherburn.

Dissatisfaction with things as they are, and a desire for the greater perfection which constantly pictures itself before the inner vision of the earnest worker in any branch of scientific industry, are characteristic features of the age we live in, and create an unrest which nothing but periodic change or experiment can satisfy. Such change, when the result of systematic research and of progressive experience, tends toward perfection, though accompanied by temporary failures which pave the way thereto.

That there is another kind of change, which is not advance, but merely transference to another part of a "rut"—formed circus-like, by perpetual travel round a fixed centre—is so well known as to need no demonstration. To be a rut-maker of the former type—*i.e.*, a pioneer on an upward track—is never easy, but is ever worthy, work. To run in (and widen) a track thus started is also good. But why the latter type exists, and how to turn the power thus wasted into useful, effective work, demand consideration in these strenuous times.

That the gas industry—both making and using—is a fruitful and fascinating study (in spite of dirt and discomfort) is proved by the many earnest and persistent students engaged upon its problems, and the mass of food for thought presented through the medium of our splendid periodical literature.

Antiquarians and others enjoy peeps into the past; and we all feel deep interest in the story of the persistent efforts of the pioneers of our respective industries—at times going so far as to exclaim, "No times like the old times." Yet, with all respect to past times and workers, the present are the greatest (to us) of all times, and call for the best that is in us, and give promise of most abundant return for our labours.

I have been trying to imagine what will be the thoughts of the workers of 1951, when looking over the volume of the "Journal" for 1901. I cannot but believe that—while feeling their own advantage—they will be interested, and perhaps astonished, to note the great range and importance of the subjects engaging attention at this time.

This is indeed a transition period (perhaps every age has felt the same); and the problems claiming solution are great and vital ones. It is, therefore, of the utmost importance that our equipment be of the best, and our methods such as modern experience has proved to be the wise ones.

That our present methods leave much to be desired, few will deny; feverish haste on the one hand, and indolence on the other, resulting in an almost utter lack of systematic research. The latest presidential addresses of eminent leaders in scientific industry are significantly unanimous in asserting this fact, and urging an immediate remedy.

Take but one branch of the gas industry—domestic heating—as an instance of this need for systematic research. In the single case of fires (so-called), an examination of fifty different patterns, from the stocks of (say) five manufacturers, would probably reveal twenty different forms of burner, a close inspection of which would show an almost complete absence of uniform proportions between areas, capacity of mixing chambers, gas injectors, air inlets, and combustion orifices.

The same "variety" of fire-box, hood, projection of fire, and size and position of the flue outlet will also be found; and while a few—very few—makers have attained good results, and refuse to pander to every cry for changes which will eventually lead to trouble and discredit, how many fires are still constructed without regard for safety and efficiency? It is painful to contemplate, and tempts one to wish sometimes that gas was not quite smokeless in combustion, so that confiding souls might get some little warning as to where the non-vitiated (?) products of combustion were going to. Add to this the only piece of uniformity noticeable—the *monotonous resemblance in outward form* so strikingly illustrated at a general exhibition, and what wonder if the (not quite unmerited) phrase "In a Rut" be used to describe the position.

However, as we are not all satisfied with the rut, and do not intend to remain there, how shall we best get out and keep out? The first step will be to abandon the fitful and unsatisfactory methods (?) by which we have attempted to catch the market season after season—viz., to rush out some half-finished experiment, containing perhaps the germ of a success, only to bring endless trouble and annoyance, and raise prejudices from which both good and bad suffer for long afterwards, To make matters worse, the experiments are then usually dropped until the season comes round again, when a similar process is repeated. It is a "muddling through" very suggestive, perhaps, of parliamentary procedure. But is it a wise plan? Surely not! The remedy has been already indicated—viz., permanent systematic research and continuous experiment.

It is perhaps too advanced an idea to suggest such research being conducted for the public good, though many a less useful labour has been so conducted. A private company might think it too great an undertaking, although, in the case of prominent progressive ones, it is open to question. Yet what is there to prevent two or more combining to conduct such systematic research for their mutual benefit? I cannot see anything vital. Instances innumerable point to the wisdom and ultimate advantage that some such effort might demonstrate.

With definite aims, and perfect freedom from commercial considerations for the time being, experiments could then be made and followed up to satisfactory conclusions in a similar manner to those which produced the incandescent light and many of our greatest inventions of to-day.

That more rapid progress has not been made, can scarcely surprise those who are familiar with the present system, whereby such experiments usually fall into hands already more than full with the multiplicity of demands which the wide field covered (or attempted) by the average British manufacturer occasions.

If these suggestions are successful in stimulating the thoughts

of your readers who have this promising branch of the gas industry at heart, I am sure some wise and progressive measures will result which will leave the "ruts" in the sole possession of the dead or dying.

PERSONAL.

Mr. William Keenleyside, the oldest official of the Consett Iron Company, has just retired, after actively serving the firm for nearly 42 years. Mr. Keenleyside has, however, been prominently associated with the coke-making industry of the county of Durham for the long period of nearly 60 years. He is still hale and hearty, and continues as a Director of the Consett Water Company, and the Shotley Bridge and Consett Gas Company.

Last Friday's "Coventry Herald" contained the following: "Difficulties have recently arisen between the Gas Committee of the Coventry Corporation and the Manager, Mr. George Winstanley, as to the condition of his employment. Under his agreement, Mr. Winstanley has a certain measure of freedom given to him in regard to private business; and it is in connection with this that there has been discussion. The Committee resumed consideration of the matter on Wednesday, when it was decided to give Mr. Winstanley notice to terminate his engagement in June next." Mr. Winstanley has been Manager of the Coventry Gas-Works since they were purchased by the Corporation in 1884. The post has, we believe, been worth about £900 per annum.

OBITUARY.

The Dundalk Gas Company have just been deprived by death of the services of their Secretary, Mr. J. A. Coulter.

Mr. Thomas Jenkins, J.P., the Chairman of the Dowlais Gas Company, died suddenly on Monday last week, while attending a meeting of the Merthyr Board of Guardians, of which body he had been a member for more than thirty years.

Mr. George Peile, who has just died at Shotley Bridge, at the age of about 65 years, was a member of the firm of Messrs. Priestman, colliery owners in Durham and Northumberland, and for a long period Chairman of the Shotley Bridge and Consett District Gas Company.

Last Tuesday, Mr. Henry Overbury, the Chairman of the Alcester Gas Company, died in his 57th year. He was largely concerned in all matters affecting the town; and until recently he was Chairman also of the Alcester Water-Works Company, but relinquished this office a few months ago in consequence of the state of his health.

The death is announced, as having occurred yesterday week, of Mr. William Billson, of Leicester. He was in his 72nd year, was a native of Leicester, and acted as Solicitor to the Gas Company before the Corporation acquired the undertaking. He personally negotiated the sale. Another important office held by Mr. Billson was that of Borough Treasurer, which he occupied for no less than 20 years.

The death is announced of Mr. James Easson, of Wolverhampton, after a long and lingering illness. The deceased, who was greatly respected, had been for nearly forty years the Manager of the Wolverhampton Gas Company's works in Stafford Road, and in that capacity he was a faithful and devoted servant to the interests of the Company. Mr. Easson, who was 67 years of age, leaves a widow and family to mourn his loss.

Judging from what took place at a recent meeting of the Hertford Corporation, as reported in another column, the members of that body are not quite so ready as they might be to appreciate good service rendered to the town. With the view of showing what could be done in the way of improving the public lighting, the Gas Company have made occasional gifts of incandescent gas-burners, and have lately put up a lamp supplied with intensified gas. The improvement effected as the result of the earlier experiments led to their Secretary and Manager (Mr. Robert Watson) submitting a scheme for a general adoption of the incandescent system, the details of which were given in the "Journal" some weeks ago. The Company offered to supply the lanterns and burners and maintain them at certain rates per annum, or, alternatively, to maintain only—the lamps and burners being provided by the Corporation. It was recognized that the latter figures were absolutely cost prices; yet they were rejected on the ground that the Corporation ought to keep the management of the lamps in their own hands, and not be "under the control of any Company." This will involve an extra outlay; but they are determined to be independent, even if they have to pay more for it. But while they are so anxious for freedom from the Gas Company's control, they somewhat illogically place themselves in the hands of an Electric Lighting Company, by handing over a part of the town to them for the purposes of an experiment in arc electric lighting by five lamps, at a cost of £25, though Professor Forbes told them that Hertford did not lend itself to this system. It was, however, this or nothing electrical; for a deputation of the Council went over to Barnet to see how the electric light was behaving there, and found the incandescent electric lamps were not so good as the ordinary gas-lights in their own town. The new system just adopted will only make the comparison more "odious."

TECHNICAL RECORD.

GAS-ENGINE RESEARCH.

The Second Report of the Gas-Engine Research Committee of the Institution of Mechanical Engineers was submitted by Professor Frederic W. Burstall, of the Birmingham University, at the first general meeting of the new session of the Institution last Friday. Interested readers may remember that the first report was presented in 1898,* and since then a great deal of work has been accomplished by the Committee, as is testified by the many pages of tabulated tests and diagrams which accompany the present report. Altogether the report and tables (excluding the engine diagram) occupy 58 printed octavo pages; so that we can only give extracts and such points as appear useful to readers of the "Journal." Those who are concerned in the deeper investigation of the subject will no doubt secure a complete copy of the report.

In their first report, the Committee gave an account of the apparatus and engine which were used for the experiments, and of a small number of preliminary experiments made to pave the way for a more extended and complete series. The engine used throughout the research was one specially constructed by Messrs. Fielding and Platt, of Gloucester, and was arranged so that the compression could be altered from about 30 lbs. per square inch to about 105 lbs. per square inch. The normal speed for the engine was 200 revolutions per minute; the diameter of the cylinder was 6 inches; and the stroke was 12 inches. The tests were all made with lighting gas, which was supplied from a gas-holder capable of containing about 100 cubic feet. This quantity would suffice to run the engine at full power for about fifty minutes. In general, the tests lasted half an hour. In most cases, such short tests would not be desirable; but in a plant like that used in the research, it is possible to obtain such steady conditions that the length of a test can be shortened without in any way affecting its accuracy. In the first report, information was also given of the apparatus and the methods employed for the calibration of the instruments. For the objects of the present report, all that is required is to state that—in addition to such measurements as quantity of gas, indicated and brake power, number of revolutions and explosions, temperature and quantity of jacket water—the air supplied was measured by a wet meter, and an analysis was made of the exhaust gases. Some alterations and additions, however, were made to the apparatus formerly described, and an account of these changes is supplied.

In the first report, some account was given of the failure to obtain a satisfactory electric igniter. The time expended on these unsuccessful experiments was not altogether wasted, as the experience then gained led to the design of a perfectly satisfactory igniter. In the previous experiments, a high-tension spark was employed; and thus great difficulties were encountered in order to keep up the insulation. The present electric igniter is worked with a spark which is produced when a low potential circuit containing iron is broken. The difficulty with this method is to produce the break of the circuit inside the cylinder. Attempts were made to do this by means of the motion of the piston, but without success. The igniter consists of a threaded plug which screws into the cylinder in the position where the ordinary ignition-tube is placed. From the lower extremity of this plug project two steel rods about 3 inches long; the rods being connected together by a short bridge-piece in which is fixed a platinum tip. The difficulty in the construction of the igniter was to insulate the moving contact. This was effected by insulating the whole of the upper part of the plug containing the gland through which the sliding-rod moves from the lower part which screws into the cylinder. The insulation is formed of mica discs, placed both above and below a ring forming part of the upper plug. These mica discs are forced down on the ring by means of a nut threaded on to the lower plug. The moving contact consists of a steel rod tipped with platinum, and passing through a gland packing in order to prevent leakage of gas. The packing is a mixture of asbestos and plumbago. The moving rod is forced down by a spiral spring, and lifted by a bell-crank lever. Owing to the fact that the rod must be insulated from the body of the cylinder, the lever has also to be insulated. It is therefore made in two parts, which are fastened together by bolts passing through ebonite washers. The lower end of the bell-crank lever has attached to it a roller, which passes on to the exhaust cam. The time of the passage of the spark is altered by fixing the roller at different distances from the cam. Current was obtained from four storage cells having a capacity of 50 ampère-hours. It was found that to obtain regular ignition, the spark must be short and thick. Any smaller number of cells did not in all cases produce ignition. The results have been most excellent. The igniter has been in use without repair for more than two years, and has never been seen to fail to fire the charge. As compared with the hot tube, it has many advantages from an experimental point of view; and by means of the spark, charges which are so weak as to give irregular results with the hot tube, can be ignited with certainty.

* See "Journal," Vol. LXXI., p. 399.

Then the method of driving the steel wires which are attached to the indicator were slightly altered from the form that was first used, in order to obviate the necessity for correcting diagrams for the unequal multiplication of the driving gear. The swinging shaft was driven by the sector of a circle which was keyed on to the shaft. The sector was connected to the piston by means of steel tapes, which were kept at constant tension in order to prevent any loss of motion.

The same form of apparatus for the collection of exhaust gases was used as described in the first report. To remove any question of air being sucked in from the small valve at the back of the collecting-tube, the valve was removed, and the tube connected to a water-pump was attached inside. During the tests, the water-pump kept working, and drew a considerable volume of the exhaust gas past the collecting-valve. The gases were analyzed in an apparatus also used for the analysis of the coal gas.

The system which was followed in making the experiments was to work on four compressions. These are lettered: A compression about 55 lbs. per square inch, B compression about 71 lbs. per square inch, C compression about 93 lbs. per square inch, and D compression 124 lbs. per square inch; the pressures being absolute. The speed was kept the same for the whole of the tests—that is, about 200 revolutions per minute. In all cases the load on the brake was adjusted so as to make the number of explosions missed as small as possible. In the appendices, we find 24 pages of tables devoted to these tests; but their reproduction would claim too much of our space. However, a large amount of information will be gathered from Appendix VII.

Interest and instruction are to be derived from the part of the report explaining the methods adopted in conducting the tests. For instance, it is remarked that experiments on gas-engines when a considerable number of explosions are missed give rise to such varying ratios of air to gas as to render them useless from a research point of view. This is due to the fact that, when a blank charge of air is drawn in, the residue in the clearance space is more than usually diluted with air, and the indicator diagram following the blank charge is not the same shape as those which follow an explosion. Then, again, it is mentioned that all volumes, both of air and gas, were reduced to standard conditions—that is, to a temperature of 15° C. and a pressure of 760 mm. of mercury. Generally the ratio of air to gas was found by assuming that, at the end of the suction stroke, the cylinder is filled with only air and gas. If the temperature of the mixture be assumed, the volume of air can be calculated from the ordinary gaseous laws. This method (Professor Burstall says) is certainly not correct, as there is always in the clearance space a volume of the products of combustion which have been left over from the previous explosion stroke. The temperature of the mixed air and gas was generally taken as not differing greatly from the jacket temperature—an assumption which is not in general borne out by the present experiments. If an accurate analysis of the exhaust gases can be made, it is possible to find the ratio of air to gas in a somewhat similar manner to boiler tests, where the weights of air per pound of coal are found from the analyses of the flue gases and coal.

We must pass over the Professor's statements on this point, until we come to the part of the report where he deals with the indicated power. This, he remarks, was derived from the net mean pressure on the piston—that is, subtracting from the gross mean pressure as measured the average mean pressure during suction and exhaust. He would have preferred to derive the indicated power from the gross mean pressure, and to consider suction and back-pressure as forming part of the mechanical losses. The case of a steam-engine in which the auxiliary pumps are driven from the main engine would support this contention. Having the temperatures of suction, it is a simple matter to calculate the temperatures at any other point from the known pressures and volumes—such temperatures being the mean temperatures throughout the cylinder. In another portion of the report, it is shown that there is reason to suppose that the temperature throughout the cylinder is not uniform, but that the core may be hotter than the mean. The highest calculated mean temperature is nearly 2000° C.; and it is possible that the core is hotter even than this. Most authorities have considered 1600° as the upper limit; but Professor Burstall is of opinion that this temperature is too low.

In finding the additions of heat both at constant volume and constant pressure, and in finding the changes of internal energy, it is necessary to know the specific heat of the burning mixture, which consists of nitrogen, carbonic acid, oxygen, and water vapour. The reporter consulted most of the original memoirs dealing with the subject, and decided to adopt the values obtained from the experiments of MM. Mallard and Le Chatelier on the specific heat at high temperatures. Their investigations show that the specific heat is not constant as had been supposed by the older *savants* but increases with the temperature. The values are for specific heat at constant volume at temperature t.

Carbonic dioxide	$0{\cdot}1477 + 0{\cdot}000176\,t$
Water vapour	$0{\cdot}3211 + 0{\cdot}000219\,t$
Nitrogen	$0{\cdot}170 + 0{\cdot}0000872\,t$
Oxygen	$0{\cdot}1488 + 0{\cdot}0000763\,t$

These results are not in agreement with those obtained at low temperatures, nor do they agree with Dr. Jolly's researches by means of the steam calorimeter. But for temperatures such as are found in gas-engines, they form the only available experiments. The values of the specific heat for different mixtures of air and gas are given in the diagrams headed "Relation of Suction Temperature and Air to Gas" (called Plate 7 in the original). These appear on p. 1034.

The expansion period, says Professor Burstall a little later on, is perhaps the most interesting point in connection with the gas-engine. If the constant specific heat be adopted, it will be found that, during expansion, instead of heat being lost to the walls as would have been expected, there is an apparent gain of heat by the charge which has been named after burning. If the hypothesis of a variable specific heat be adopted, it will be found that in almost all cases there is heat lost to the walls, and that combustion is complete at the point of maximum temperature. To determine this, an adiabatic curve is drawn through the point of maximum temperature, and continued to the same volume as exhaust. The experiments would tend to prove that for maximum economy the expansion should be nearly an adiabatic. Thermodynamics show that for maximum economy all the heat should be added at maximum temperature, and that any after-burning is detrimental.

In finding the heat discharged to exhaust, it has been general to estimate the heat as the change of internal energy of the whole weight of the charge in cooling from the temperature of the exhaust to the temperature at the end of the suction stroke. Part of this energy only passes out; the remainder being supposed to be given to the jacket. In the heat account for these tests, the heat rejected to the exhaust was divided into two parts—first, the heat energy of the total weight of air and gas taken in, the products of combustion being cooled down to atmospheric temperature; second, that part of the charge which does not pass out of the cylinder, but remains in the clearance space, to mix with the air and gas on the next stroke. Some of the heat energy, however, does pass out, being converted into kinetic energy of the exhaust. To estimate this amount, the charge in the clearance space was supposed to expand adiabatically from the exhaust pressure to the atmospheric pressure; the change of internal energy due to this expansion was taken as the heat lost by the residue to the exhaust. The amount of heat thus determined is not large, forming about 3 per cent. of the total heat. The amount of the products of combustion in the clearance space varies, of course, with the compression and with the suction temperature. For the A tests of the whole weight of charge, about 25 per cent. is residue; for B tests 16 per cent.; for C tests about 15 per cent.; for the D tests about 8·5 per cent. In forming a heat-balance by the two methods, there will not be a great difference between the internal energy at the exhaust and the heat energy of the incoming air and gas when cooled from the exhaust to the atmospheric temperature, when the compression is high, as then the influence of the clearance residue is small. But for low compressions, there is a marked difference between the two. If any method of finding the heat rejected to the exhaust is correct, and leads to a fairly accurate heat-balance, it must apply to all cases. The figures are given for 38 tests under varied conditions, and the heat balances are as good as can be expected for such a complex problem.

In the well-known experiments of Dr. Slaby, who used a slightly larger engine with a slide-valve and low compression, the best thermal efficiency was about 16 per cent., and the loss to the exhaust nearly the same as in his own experiments. The loss to the jacket, however, was much larger than in the reporter's tests; and modern gas-engines owe their improved efficiency mainly to a reduced wall loss.

As to the effect of a scavenger charge, this may be inferred from the relative weights of the incoming charge and the clearance residue. If the latter can be expelled, a larger total volume of charge can be drawn without greatly increasing the jacket loss; but the gain diminishes as the compression is increased. For many reasons, very high compressions are not desirable; and Professor Burstall wishes to draw attention to the fact that at present gas-engines are only utilizing about one-third of their total temperature range when working under best conditions, while in steam-engines more than three-quarters of the temperature range is utilized. The additions of heat of various portions of the stroke have been worked out; and an example from each of the four compressions is given in Appendix VI. Want of space prevents the results being given here in full. The heat additions give a check on the heat-balance; and the results for the whole of the tests are in fair agreement. Had the specific heat of the charge been taken as constant in the calculations, the results would have been about 15 per cent. smaller.

The values taken for the heating values of the gas in Tables 1 and 2 (Appendix I.) are those of Dr. Slaby; and in each case the latent heat of the water formed by combustion has been deducted. As to which of the two values is to be used for the calorific value of a gas, all authorities are not agreed. If the heating value of a gas be determined by burning in a calorimeter such as the Jünkers, the result will be the higher, because the products of combustion have been cooled to nearly atmospheric temperature. From a logical point of view, the heating value of a gas should be taken as the heat given out when the products of combustion are cooled down to the original temperature of the incoming air and gas. This includes as part of the heating value of the gas the latent heat of the water vapour which is produced by the combustion of hydrocarbons. In an average coal gas, the latent heat of the water vapour amounts to nearly 10 per cent. of the gross heat as measured in the calorimeter. The justification for adopting the lower number for the calorific value is, that in all practical applications of gas, whether in a gas-engine or in a furnace, it is

almost impossible to conceive any arrangement by which the water vapour could be rejected as water, and not, as is always the case, in the form of steam. It has generally been the custom, both in this country and in Germany, to use the lower value; and as it is most desirable that there should be a uniform standard, the Gas-Engine Research Committee and the reporter would suggest the use of the lower value as being a measure of the available heat of the gas, whereas the higher value is not a practical standard of the heat which can be utilized outside a calorimeter.

Dealing with the question of radiation, Professor Burstall says: The heat which is rejected into the jacket-water will, of course, be slightly less than the heat which is passed through a cylinder wall, due to the fact that some of the heat is radiated from the outer surface of the cylinder into the air. Although this amount was comparatively small, it was deemed advisable to make a special experiment in order to determine its amount. After the jacket had been raised to the required temperature, the engine was stopped, and a measured supply of hot water allowed to pass through the jacket; the temperatures of the water both at the inlet and the outlet being measured. The radiation can then be determined from the difference of these temperatures together with the known weight of water. Results are given in Appendix IX.

A series of experiments were made in order to determine if it were possible for carbonic oxide to exist in the exhaust—that is to say, whether combustion ever took place in the exhaust-pipe. In no case, however, could the smallest trace of carbonic oxide be discovered, although, had there been as little as $\frac{1}{10}$th part of 1 per cent., it would have been detected.

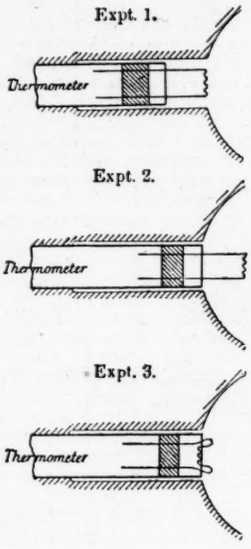
One of the principal objects which the Research Committee had in view was the determination of the temperatures at all points of the "Otto" cycle, by means of a direct measurement in place of by the usual indirect method of calculation. When the reporter commenced the research to determine the temperatures reached in the gas-engine, it seemed as if the best method to employ was that of the electrical thermometer in a modified form. The difficulties were considerable, as not only were the temperatures to be measured very high, but the pressure which such a thermometer had to withstand was also great, and the total duration of the temperature not more than $\frac{1}{3}$ of a second. If it were required to measure the temperature at different points of a stroke, it became clear that the measuring wire must possess a very small thermal capacity; and a very small thermal capacity necessitated the abolition of any covering to the wire. At first it seemed probable that to expose a very fine wire to the erosive influence of the burning gas would be likely to lead to inaccuracy in the measurements. This, however, has not been found to be the case. The change of resistance of a wire when it has been exposed to several hundreds of explosions, is almost too small to be measured. The form of the thermometer finally selected consists of a solid drawn steel tube about 1 inch in diameter and 18 inches in length; the thickness being about $\frac{1}{20}$ of an inch. The outside of the tube is threaded from end to end, and has upon it a pair of nuts. This allows the measuring wire to be placed at any distance from the wall of the cylinder; the nuts also serving to hold the thermometer in position by means of an ordinary screwed gland packed with asbestos. The reporter gives a minute description of the construction of the instrument.

The general principle used in measuring the temperature was to cause the engine itself to complete the galvanometer circuit at the particular point of the stroke at which the temperature was required to be measured. This would be a simple matter with a steam-engine, as all that would be necessary would be a circuit measure placed on the shaft. With a gas-engine, an explosion can at most occur but once in two revolutions. Hence some means must be devised whereby the circuit shall be closed, not only at the definite point in the stroke, but also only when an explosion has taken place. Moreover, as the size of the measuring wire must of necessity be very small—ranging from 0·0025 to 0·0015 inch—it becomes of the highest importance to expose the wire to the high temperature for as small a number of explosions as possible. All attempts to use these measuring wires with an engine firing every second revolution have resulted in the destruction of the wire before a sufficient number of observations could be taken. The temperatures have therefore been measured on an engine running dead-light—that is, firing about one in six of the possible explosions. There is also the difficulty of ensuring that the wire follows the temperature of the gas during expansion. This can be done provided the gas-engine does not run at a speed much exceeding 120 revolutions per minute. The galvanometer used was a Crompton d'Arsonval; and the method adopted in its application is treated very fully by Professor Burstall.

In addition to measuring the temperatures during the explosion stroke, the suction temperature was also measured. Having now the pressure P, volume V, and temperature T, at the end of the suction stroke, and also at various points on the expansion curve, it is possible to calculate the product $\frac{PV}{T}$ both before and after explosion. This was done, with the result that, assuming that the suction temperatures were correct, the measured temperatures during expansion were very much too high. This is found in the whole of the tests, and is more strongly marked with the very fine wire. With a view of checking the way in which the wire followed the temperature, the temperatures were measured from beginning to the end of compression, and the results are shown in the table. They prove that the wire actually followed the temperature with a very reasonable degree of accuracy. It is also conjectured that, as the indicator diagrams were taken with the indicator open, while the temperatures were measured with the indicator shut, perhaps the leak through the indicator was sufficient to account for the higher temperature as shown by the thermometer. An experiment was made with the indicator open and shut, with the result that the indicator open showed a slightly higher temperature. It occurred to the reporter that possibly the discrepancy might be accounted for on the hypothesis that the temperature throughout the cylinder was not uniform. All the temperatures were measured on wire almost in the centre clearance space, which naturally would be the hottest part. The calculated temperatures are, of course, the mean of the whole temperature throughout the cylinder.

Three experiments were made with the measuring wire placed in different positions—in the first case on a level with the inner wall, in the second case standing out some $\frac{1}{2}$ inch, and in the third case with the measuring wire bent back as near as possible to the steel body of the thermometer, so as to imitate the cooling action of the wall. The temperatures thus obtained show a very decided falling off as the wire is brought closer to the wall, amounting in one case to nearly 200° C. Doubtless the wall action in the case of a very low speed of some 90 revolutions per minute would be much more marked than at the ordinary speed of 200 revolutions per minute; but the experiments prove that there is a comparatively wide range of temperature in the cylinder itself. If it were possible to place one of the measuring wires at 0·01 inch from the wall, it is probable that even when the core was standing at some 1300° C., the temperature at the wall might not exceed 800° or 900° C. The existence of even a thin layer of comparatively cold gas on all the clearance surfaces would be sufficient to reconcile the temperatures calculated by means of pressures, volumes, and temperatures of exhaust with those observed; but until the law of variation of temperature throughout the cylinder has been determined, such a calculation would be of comparatively small value.

Experiment Showing Variation of Temperature with Thermometers at Different Depths in Cylinder.



	Temp. at $\frac{3}{10}$ of stroke.	Temp. at $\frac{8}{10}$ of stroke.
Expt. 1.	977° C.	714° C.
Expt. 2.	1110° C.	765° C.
Expt. 3.	904° C.	624° C.

From the numerous tables we only give (as being of greatest interest to "JOURNAL" readers) those appearing in Appendices I., VI., VII., and IX.

APPENDIX I.

TABLE I.—*Analysis and Products of Combustion of Coal Gas by Volume.*

Mean of Eight Samples.

	Per Cent.	Carbonic Acid Produced.	Oxygen Required.	Steam Produced.
Carbon dioxide	0·16	0·16	—	—
Heavy hydrocarbons, $C_3H_{6\cdot7}$	4·48	13·43	20·93	15·0
Oxygen	0·13	—	—	—
Carbon monoxide	9·46	9·46	4·73	—
Marsh gas, CH_4	33·67	33·67	67·34	67·34
Hydrogen	43·40	—	21·70	43·40
Nitrogen	8·70	—	—	—
Totals.	100·00	56·72	114·70	125·74

One volume of coal gas requires 5·49 volumes of air, and produces 0·5672 volume of carbonic acid and 1·257 volumes of steam. After combustion, the volume dry is 4·996.

Weight of 1 cubic metre of gas dry at 15° C. 760 mm. = 0·600 kgs.
" " " air " " " = 1·290 "

TABLE II.—*Heating Value of Coal Gas.*

The heating values are taken less the latent heat of water vapour, and are in calories.

—	Per Cent. by Volume.	Heating Value of 1 Cubic Metre at 15° C. 760 mm.	Heating Value of each Constituent in 1 Cubic Metre of Coal Gas.
CO_2	0·16	—	—
$C_3H_{6\cdot7}$	4·48	20,090* calories	900 calories
O	0·13	—	—
CO	9·46	2,878 ,,	272 ,,
CH_4	33·67	8,030 ,,	2,704 ,,
H	43·40	2,440 ,,	974 ,,
N	8·70	—	—
Totals.	100·00	—	4,850 calories.

* Heating value of 1 cubic metre of $C_3H_{6\cdot7} = 1000 + 10{,}500\,d = 20{,}090\,d$ = density being 1 912.

Heating value of 1 cubic metre of coal gas = 4,850 cal.
,, ,, 1 cubic foot ,, ,, = 553 B.T.U.

APPENDIX VI.

HEAT ADDITIONS. CALORIES PER EXPLOSION.

Trial No.	Ratio: $\frac{Air}{Gas}$	Heat added at Constant Vol.	Heat added at Constant Pressure.	Change of Internal Energy during Expansion.	Gross Work done during Expansion.	Gross Work done during Compression.	Change of Internal Energy during Compression.
A_6	10·3	1·329	0·807	0·902	0·568	0·239	0·181
B_7	9·8	1·120	0·929	0·953	0·626	0·278	0·303
C_7	11·0	0·42	1·19	0·616	0·534	0·308	0·303
D_7	10·8	0·36	1·04	0·594	0·626	0·351	0·334

HEAT GIVEN TO JACKET.

Trial No.	During Constant Volume and Constant Pressure.	During Expansion.	During Compression.	Total.	Measured.
A_6	0·48	0·33	0·06	0·87	0·83
B_7	0·37	0·33	0·02	0·68	0·77
C_7	0·53	0·08	0·01	0·62	0·64
D_7	0·74	−0·03	0·02	0·73	0·66

APPENDIX IX.

Experiments on Time of Firing Charge.

Test No.	Compression Pounds per Square Inch.	Nom. Ratio Air to Gas.	Firing Point Fraction of Stroke.
B_7	71	8·7	0·76
B_8	,,	9·8	0·68
D_3	124	7·4	0·97
D_4	,,	8·0	0·96
D_5	,,	8·4	0·88
D_7	,,	9·9	0·87
D_8	,,	10·7	0·86
D_{10}	,,	11·7	0·74

Experiment on Temperature during Compression.

Point 0 = beginning of compression.

Point of Stroke.	Temp. C.° Absolute.	Pressure Kg. per Cm^2.	Volume Litres.	$\frac{PV}{T}$
0	299	1·077	7·567	0·0272
0·1	307	1·179	7·015	0·0269
0·2	315	1·311	6·463	0·0269
0·3	316	1·472	5·910	0·0275
0·4	324	1·676	5·358	0·0277
0·5	334	1·940	4·806	0·0279
0·6	344	2·277	4·254	0·0281
0·7	355	2·715	3·702	0·0282
0·8	377	3·314	3·149	0·0277
0·9	402	4·193	2·597	0·0271

Radiation Test.

Inlet.	Outlet.	Heat Radiated per Hour.	Mean Temperature.	Air Temperature.
C.°	C.°	large calories	C.°	C.°
74·2	62·5	436	68·3	16
69·3	58·8	376	64·0	16·2
59·5	51·2	360	55·3	17·0

Experiment Comparing Temperatures measured with Indicator Open and Shut.

—	Indicator Shut.	Indicator Open.
	C.°	C.°
0·2 of stroke.	1150	1190
0·8 ,, ,,	939	988

Trial for Carbonic Oxide with Cooled Exhaust.

Revolutions per Minute.	CO_2.	O.	CO.
180	8·03	6·31	0

APPENDIX VII.

Table Showing Effect of Change of Compression—Lighting Gas.

Trial No.	Ratio of Clearance Volume to Cylinder Volume.	Jacketed Surface Per Cent. of Clearance Surface.	Compression in Atmospheres.	Revolutions per Minute.	Explosions per Minute.	Temperatures C°. Suction.	Compression.	Explosion Maximum.	End of Adiabatic Expansion.	Exhaust.	Power. I.H.P.	B.H.P.	Mechanical Efficiency.
A 7	0·57	71	3·75	206·8	99·2	99	311	1145	952	857	3·86	2·72	0·70
B 9	0·45	69	4·86	203·5	97·3	90	336	1098	852	747	3·81	2·51	0·66
C 7	0·34	62	6·30	201·6	92·5	94	328	1154	897	817	4·03	2·45	0·61
D 8	0·25	58	8·44	200·2	93·7	84	359	1094	707	749	4·06	2·81	0·69

Trial No.	Exhaust. CO_2 Per Cent.	Exhaust. O Per Cent.	Ratio Air to Gas.	Gas. Cubic Feet per Hour. Per I.H.P.	Per B.H.P.	Lower Heating Value of Gas B.T.U. per Cubic Foot.	Temperature Jacket Water. Inlet.	Outlet.	Heat Balance Percentages. I.H.P.	Jacket.	Exhaust.	Radiation.	Total.	Thermal Efficiency on B.H.P. Per Cent.
A 7	5·83	11·11	10·6	24·6	34·9	547	11	64	18 9	29·0	49·4	2·7	100·0	13·2
B 9	5·36	11·73	11·4	22·0	33·5	547	14	61	21·2	29·0	43·2	3·0	96·4	14·0
C 7	5·39	10 99	11·0	20·7	34·1	562	16	61	21 9	30·0	43·9	2·8	98 6	13·4
D 8	5·28	11·93	11·9	19 7	28·5	559	15	66	23 1	30·0	42·6	3·0	98·7	15·9

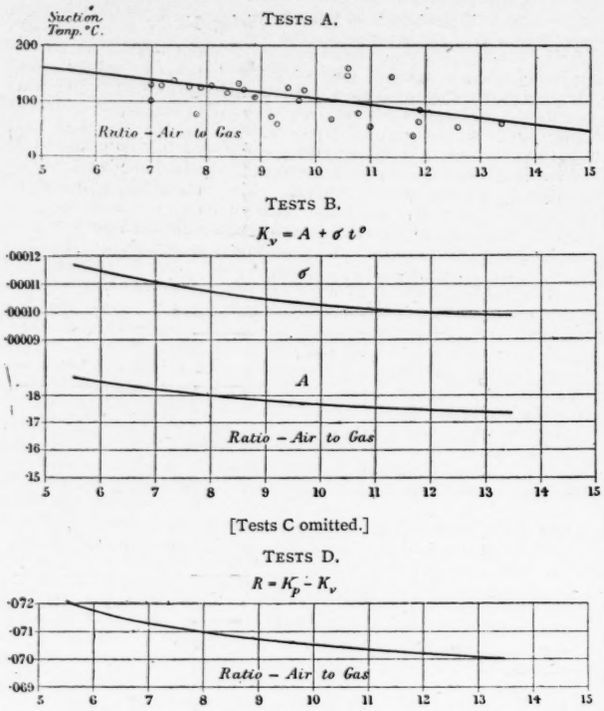
Discussion.

The PRESIDENT (Mr. W. H. Maw) said the members would all agree that the report contained an enormous amount of hard conscientious work. Professor Burstall had not only conducted a large number of careful experiments, but he had devised the means whereby the experiments were carried out; and the devising of these means, he need scarcely say, had made very heavy demands upon his time. The report, as it stood, opened up two complete lines of discussion. First of all, the criticism of the methods which the Professor devised, and, secondly, the discussion of the results he had obtained by these methods. It was very important they should pay attention to both these lines of discussion; because the experiments were, he hoped, only the earlier ones of a prolonged series, and they ought to consider every point in their progress. Before the discussion was opened, he would ask the members to pass, by acclamation, a vote of thanks to Professor Burstall for the great pains he had devoted to the work, and for the trouble he had taken in bringing the tests forward in such a complete way.

The vote was carried by applause.

Professor BURSTALL acknowledged the vote, and then alluded to certain points in the report which struck him as important from the practical point of view, as necessarily a large amount of the report was devoted to theoretical considerations. He said he would first of all draw attention to the question of ignition. It was, he believed, pretty generally accepted that, for quite small engines, such as the one used in this research, the hot-tube was most useful for ordinary practical running. When, however, they came to consider the large engine, he thought the results of the researches showed that electrical ignition possessed certain very great advantages, and that the hot-tube ignition might at times be slightly delayed. With the electrical ignition (provided a sufficient volume of spark was produced), it was hardly possible to fail to fire a charge; and even a slight delay in firing a charge

Relation of Suction Temperature and Air to Gas. (*Plate 7.*)



[Tests C omitted.]

in an engine of 300 to 400 horse power was a serious matter. He trusted the English makers would soon follow the Continental practice, and put in electrical ignition to all engines beyond 50-horse power, as a matter of course. He would also like to say a little about the influence of compression. A special table was given (Appendix VII.), which showed the influence of compression, keeping the ratio of air and gas approximately constant. Now the change in the thermal efficiency was not as large as it would have been had it been possible to construct an engine with the same ratio of clearance surface in all cases. In series A and B, the change of compression was produced in certain instances by packing-pieces on the big end of the connecting-rod; and in C and D junk-rings bolted to the piston were employed. The influence of this was to check the increased economy which had been given by the compression. The results shown diagrammatically on Plate 7 were of interest; and for the following reason: It was marked "Test A," but it should apply to the whole 38 tests. Now this was, so far as he knew, the first time the suction temperature had ever been determined at all; and it would be noticed that the temperatures varied from 140° C to as low as 69° C., or even 64° C. These temperatures were very much higher than previous authorities had considered to be the case; and the high value of the suction temperature explained at once one of the reasons for the increased economy of the modern scavenger engine. If the temperature of the suction charge could be reduced by some 30°, the quantity of air and gas sucked into the cylinder would be increased nearly 10 per cent.; and as the losses to the wall were not proportional to the weight of the charge, but to its temperature only, the result was an increase in the average mean pressure on the piston, and this was produced partially by the water-jacketing of the piston and the water-jacketing of the clearance space, and by efficient scavenging, which cleared out all the residue and cleared the cylinder wall. In the heat balance, he had altered somewhat what had hitherto been customary, and he had not closed the cycle—that was to say, the heat additions had been calculated from the suction temperature, which was 60° to 80°, and he finished up at exhaust with a temperature of 15°, leaving a vacancy between the two. This was a matter a great many people would not agree with; but it was reasonable to suppose the cycle was an open one. He would now pass on to the temperature tests. These to him were of great interest indeed, because they served to show certain phenomena that no tests made with an indicator could possibly reveal. They proved fairly conclusively that combustion was complete at maximum temperature, and next that during expansion the charge behaved as a perfect gas. Both points had been doubted. Now he thought they must look to the existence of after-burning (so-called) as merely due to the neglect of the possibilities of the variable specific heat. The variability of the temperature throughout the cylinder took him entirely by surprise. He had hitherto looked upon it as an absolute impossibility to consider that the temperature throughout the cylinder was not uniform, owing to the enormous velocity of flame propagation which took place when the charge was ignited. All his experimental results had tended in the same direction; and he should not be satisfied until he determined how the temperature varied in the cylinder, presuming they had a cylinder in which the variability of the temperature could be tested.

Professor A. B. W. KENNEDY (the Chairman of the Research Committee) said the duties of a Chairman of a Research Committee were simple and pleasant. He sat by, and gave his most valuable advice. But he had no work to do. When, however, the end came, the Chairman in this instance would not take any credit for the work that had been done. He was, however, glad to have been connected with the work even in this somewhat idle capacity. He thought that the President had indicated pretty clearly the two lines into which the work of the Committee as a whole was divided. There had had to be first of all an endeavour to find out the exact conditions under which the work went on in a gas-engine, and then, when these conditions had been found, there would be an attempt to apply the investigations to making of improvements in the gas-engine. Practically, they might say that the first of these sets of considerations only came in in Professor Burstall's work so far as it had gone—that was, his endeavour had been almost entirely confined to investigating the exact working conditions of the fluid in the gas-engine. Without saying for the moment—and he knew Professor Burstall would not say—the investigations were yet complete, he thought they might fairly say for themselves that the work of the Committee had (as done by Professor Burstall) gone further, and more deeply and thoroughly, into these conditions than any previous work on the subject. As to the second point—that was to say, the applying of these results to practical work—he hoped they would obtain experimental work on an engine which much more nearly resembled the sizes of engines actually used in practice. He thought that the President was going to say something about this, but it was to be his (Professor Kennedy's) pleasure, in the first instance, to say to the members that he understood, at the Council meeting that day, certain arrangements had been made by means of which a large gas-engine of 150-horse power, which was going to be put down at the Birmingham University, could be used by Professor Burstall for further experiments, in continuation of the work of the Research Committee. This he was sure would give results which would have a more direct bearing on practical gas-engine design than the results from a 5-horse power engine. At the same time, he thought the criticism that had been applied to the work of the Committee—that the work of the engine was very small, and altogether out of the region of practical engineering—was of the kind that could be called "cheap." It was perfectly obvious that, if it had been practicable to have made tests on a larger engine, they would have been made. But he was not aware that the gentlemen whose interests were most closely connected with these experiments had ever come forward with enthusiasm to help the work by getting a 100-horse power engine or anything of that kind. Therefore he did not think criticism of this sort was really worth making. The experiments were none the less true, none the less helpful in finding out what was going on in an engine, than if they had been made on a much larger engine. He was happy to think that, owing to the interest that Professor Burstall and the Birmingham University took in this work, they would be able to get, through the former, the results on a much larger scale. As to the present tests, he had only one bit of fault-finding, and that was that Professor Burstall in one part said "the results are given in the metric system, but, for convenience of comparison, a few leading figures have been given in the English units also." If the Professor had said that, for the convenience of engineering students, a few of the figures had been given in the metric system, it would have been better. He (Professor Kennedy) could not understand kilogrammes per square centimetre; and as long as he worked in inches and pounds he was going to talk of pounds per square inch. He had little doubt about it that, if those present were canvassed, there would be 10 to 1 who used pounds and inches, and only 1 to 10 who used the metric system. As to the things to be aimed at, there were two things that Professor Burstall had been trying to get—a complete analytical history of the gas at different times during the stroke, and a complete temperature record as to the gas at different times of the stroke. The analyses, he thought, he had got very completely. But the temperature history of the gas was only complete to a certain limited extent with the Callender thermometer, which, he agreed, was by far the best instrument they had for measurements of this kind. The thermometer was a delicate instrument, and would not stand the tremendous bangings it would get from an engine working under normal conditions. Therefore, in certain of these experiments, in which the temperatures were measured very completely indeed by the ingenious arrangement described, the engine was running very slow—at half speed—because of the physical difficulty that, if they allowed the engine to run faster, they smashed up the measuring instruments. Whether this would continue, he did not know, but it was not a fatal objection, because some results had been got. These slow experiments were the only ones in which the temperatures had been measured; in the other experiments the temperatures had been calculated from a given suction temperature, and the suction temperature itself was capable of calculation from observations and chemical analysis. He hoped Professor Burstall would explain exactly what he meant by "suction temperature," because it was a little uncertain. He took it to mean the temperature of the charge after it had completely filled up the cylinder. [Professor BURSTALL: Yes.] Clearly if they had that temperature, all the others could be calculated very much easier. The temperatures given in connection with experiments A, B, C, and D, he understood, had all been based on the calculated suction temperature. At some point in the experiments, Professor Burstall had got to this interesting

result, that calculated temperatures did not appear to agree with the actual measured temperatures. Then came this interesting question of the non-uniformity of the temperature throughout the burning mass. He should hope that in any engine it might be possible to find a mean temperature for it, at which the slow-going temperatures could be measured, to see whether these agreed with the temperatures calculated. Then he was glad to emphasize one of the observations of the reporter. It was this: "At present gas-engines are only utilizing about one-third of their total temperature range when working under best conditions, while in steam-engines more than three-quarters of the temperature range is utilized." Practically this was another way of saying that in any heat-engines in which the theoretical efficiency was very high, the difficulty of reaching that efficiency increased. For instance, if they had an engine which could possibily reach an efficiency of 70 per cent., they would find it much more difficult to get to a quarter of that efficiency than if the theoretical efficiency were only 40 per cent. In steam-engines it was much more easy to get a comparatively good result in a comparatively low engine than in a comparatively high one. The thing was more striking in a gas-engine where the theoretical efficiency was higher than in the case of the steam-engine. About the Callender thermometer, he should like to say a word. Professor Burstall said that moisture by wetting destroyed the insulation. He (Professor Kennedy) had used these thermometers for getting steam temperatures very often; and they were really the only satisfactory way of obtaining steam temperatures. But they must not be put into the steam-pipe direct, because the fine platinum coil got short-circuited, and the thermometer was destroyed. In his own practice, he put the thermometers in a metal envelope, which would prevent steam getting at them. This gave them a slight lag. It was, however, a lag of small amount, and probably not worth practical consideration. He should like the Professor very much to tell them, if he could, what was his own final opinion as to the extent to which measures of temperatures taken at low power fairly represented measurements of temperature taken at full load. When this report came into his (Professor Kennedy's) hands, he read it with some trepidation, because some thirteen years ago he was guilty of a good many gas-engine experiments, and, he believed, they were by far the most complete experiments then made. He ventured on a calculation of temperatures at different parts of the stroke. Of course, the Callender thermometer was a thing that did not then exist, and, in fact, very many of the arrangements Professor Burstall used did not exist, for the excellent reason that he (Professor Kennedy) had not the intellect, time, or money with which to work them out. However, he was not a little anxious to compare some of his late experiments with the present ones, to find how far they had really come out right, or how far they would have to be rejected as totally antiquated. He felt no little satisfaction in finding them corresponding uncommonly well. It might have been a fluke. It was, of course, a little difficult to get any to correspond exactly with these. He found one engine (the Crossley engine tested in the Society of Arts trials in 1888) compared very well with Professor Burstall's trials—the figures corresponded very well indeed; and so the Society of Arts trials were probably substantially right. In one respect, however, there had obviously been a mistake on the question of the variable specific heat. His (Professor Kennedy's) calculations made out in every case, except one, that the combustion was complete at the end of the stroke. They did not make out that it was always complete at maximum temperature; but Professor Burstall had come to the conclusion that it practically was. In one engine, he thought he found that the combustion was not complete at all at the end. This was due to the form of the curve on which he had been working—on, of course, the assumption of uniform specific heat. Regarding Appendix VII. (which showed the effect of the change of compression), he did not think that one must draw conclusions at all hastily from that table as it stood. He had no doubt every figure was right; but if they took other trials than those referred to in the table, he thought somewhat different results would be found. What had been done was to take one trial out of the four sets of experiments, taking trials which had obviously the same ratio of air to gas—somewhere about 10½ to 11, and so they had the four ratios of clearance volume. If they looked at the heat balance percentages and took the I.H.P., it would be seen that the figures went up—as the compression increased, the figures went up markedly: 18·9, 21·2, 21·9, and 23·1. All this showed was that, where they had this particular ratio of air to gas (between 10½ and 11), they got an increasing efficiency with an increasing ratio of compression; but he took another set of the trials which were equally comparative, and the figures became 17·4, 18·7, 18·2, and 18·1—that was, there was no such going up in the efficiency. There might be some special explanation of this, but the fact of the matter was simply that they must consider all the circumstances of the case, and remember that the ratio of air to gas had a considerable effect on the efficiency with different compressions.

Mr. Bryan Donkin (London) said, as a member of the Committee, he should like to make a few remarks upon this excellent report. He had great pleasure in expressing the same opinion as the President, that the report was quite a monument of labour and patience and care and skill. It was quite true, as Professor Kennedy had said, that the tests had been made on rather a small engine; but it appeared there was hope of having a much larger one with which to extend the research, if only their funds would allow of them being continued and enlarged. In regard to the compression of the charge of gas and air, the advantage of this was one of the chief points in the report, and the details were given with four very different compressions, other conditions being kept practically constant. Great care had been taken to make all the results as reliable as possible; and Professor Burstall had had much experience in this direction. Of course, in all accurate trials, it was important to avoid mis-fires as far as possible, as they changed the conditions inside the cylinder, and also the ratio of air to gas, as was shown by indicator diagrams if taken just after a mis-fire. As to the temperature at different parts of the stroke after an explosion, this was the first time that any reliable tests had been made; and it was the main and most interesting part of the whole report. It had evidently given Professor Burstall much trouble. The maximum temperature seemed to be in the neighbourhood of 2000° C.; and this was higher than was expected. It was extraordinary how well gas-engines worked even at such extreme temperatures. Another very instructive point was brought out that, even with the cyclonic action of the explosion, and the very short time of each explosion, the gases seemed to be very much cooler near the jacketed walls than in the centre of the cylinder—that was to say, there was some 200° C. difference in the cylinder between the gas in the centre and that as near to the wall as it was possible to measure it. The only way was to take such temperatures electrically by means of the platinum thermometer, and the way to avoid the very thin wire being broken was to work with the engine driving itself only, with many mis-fires, and without any useful load. It must be remembered that these tests were not made on full load; and this working without load was rather unfortunate. He hoped that in future some plan would be devised to get these temperatures with half load or more, as in practical working. Such results would be still more interesting than those given. The platinum wire was only $\frac{1}{100}$th mm. in diameter. The Committee appreciated greatly the labour of Professor Burstall; and the members who had studied the report would see the great amount of time and pains he had given to obtain all these interesting tests and tables. He should like to ask Professor Burstall as to the exact position the thermometer occupied in the clearance space—whether it was put in vertically, horizontally, or in any other position. In the experiments of two years ago, the Professor found the maximum heat efficiency per I.H.P. was 21 per cent. Apparently now he had arrived at the figure of 23 per cent., which was a little better. Mr. Donkin next described Mathot's continuous pressure-recorder for gas or oil engines, one of which had been kindly lent him by Mr. Dugald Clerk for exhibition at the meeting. [M. Mathot, who devised the recorder, is, it appeared, a Belgian engineer. Its object is to record on moving paper, driven by clockwork, the vertical lines of pressures or vacuum taking place during several minutes, in order to determine not only the explosion, but also the compression, exhaust, and drawn-in air, pressures, and the actual number of explosions during the time that the pencil is on the paper. So that on the paper is recorded, for (say) one or two minutes, the number of explosions or mis-fires, the initial and compression pressures of each, the number of revolutions corresponding, also the inlet and exhaust pressures. By means of the apparatus, many gas and oil engines have been greatly improved, and the power increased from 50 to 80 per cent.]

Mr. Threlfall, F.R.S., invited by the President, said what little he could add to the discussion would turn on the question of temperature measurements, of which he had made many at one time and another. He was rather struck by one statement of Professor Burstall, that, under certain circumstances, the wire fused after a very few explosions. Speaking from memory, he believed that platinum fused at about 1700° C.; but, looking carefully through the columns of figures, none of the temperatures approached 1700° C. In consequence, he was inclined to think that the temperatures measured must have been too low. Very likely Professor Burstall had tried the method of a thermo-couple, which was not so correct as the Callender thermometer when the latter could be used under the most favourable conditions. But, on the other hand, the thermo-couple had some advantages which would recommend it for this particular purpose. Another point was the great difficulty there was in keeping the platinum similar to its condition at the start; but Professor Burstall seemed to have got over it fairly well. Professor Callender's view was that one of the reasons why people failed in using the platinum thermometer was that, at high temperatures, the platinum absorbed carbon, and then it became some other kind of platinum, and so was rendered unserviceable. The speaker expressed his disappointment that the engine was so small, and said he hoped the 150-horse power engine that was expected would be an engine of one cylinder, and not divided up into three or four, because he did not consider that was a large engine.

At this point, further discussion of the report was adjourned.

Midland Association of Gas Managers.—The programme has been issued for the autumn meeting of this Association, which is to be held in Birmingham next Thursday. Apart from the election of new members and officers, the business will consist of a visit to the Saltley Gas-Works, where the members will be received by the Chairman of the Gas Committee (Mr. J. H. Lloyd) and the Engineer (Mr. Henry Hack, M.Inst.C.E.). The latter gentleman will provide a description of the gas-works extensions recently made under his direction.

MANCHESTER AND DISTRICT JUNIOR GAS ASSOCIATION.

The members of this Association held their third annual meeting on Saturday, in the Technical School, Princess Street, Manchester. The PRESIDENT (Mr. C. Berry) occupied the chair; and there was a good attendance of members.

The annual report and balance-sheet presented for adoption recorded very satisfactory progress during the past twelve months. The Council were able to congratulate the members that the Association continued to prosper, and that, in their opinion, it was fulfilling the object for which it had been established. During the past year, the Association had lost four members, and in their place nine new ones had been admitted; the present roll of membership being 49, compared with 43 the previous year, and 40 for the first year. Financially they also continued to steadily improve; their balance in hand being upwards of £11, against £6 before. It was a source of gratification to the Council, as it must be to the general body of the members, to know that very many of the members since the Association was formed had succeeded in obtaining positions which reflected credit on themselves and on the Association. Their thanks were due to Mr. J. H. Reynolds, the Director of the Technical School, Manchester, for the interest he had taken in the Association since its formation by providing them with a room for their meetings; and it was also gratifying to the Council to see that all their efforts had been so well appreciated by the members generally, as shown by the good attendance at their meetings. In conclusion, they could only express the hope that the members would continue to take a deep interest in the Association and that the Secretaries would have no difficulty in obtaining papers during the ensuing session.

The PRESIDENT, in moving the adoption of the report and financial statement, said he felt that they could congratulate themselves on the position and prospects of the Association. Considering this was only their third annual meeting, he thought they had done remarkably well to show by their latest returns a membership of 52, a balance in hand of upwards of £11, a record of 20 works visited, of 14 papers and discussions, and last, but not least, of 11 appointments from among their members to managerships and other positions of trust. Though the fact that these gentlemen had obtained such positions meant in most cases the loss of their membership and assistance in the Association, this was no cause for real regret. It was the natural outcome of the attainment by the Association of one of its chief objects, which was the advancement of the members in their technical knowledge, and consequently rendering them able to undertake the most useful work in their profession. To fill up the places of those who had left them, should be the individual effort of those who remained. Each member should lay the objects of the Association and its past programme before his junior friends in the profession; and it would then be an easy matter to double their membership. One of the best signs of their improvement was that during the past year the whole of the papers given had emanated from their own ranks; and he trusted this might continue to be so. In conclusion, he thanked all the members for the loyal support and the kind forbearance he had received from them, and especially their friend Mr. Garlick for his willing assistance in conducting the affairs of the Association during the frequent but unavoidable absences of their President.

Mr. BARBER seconded the motion; and it was agreed to.

The election of officers for the ensuing year was the next business. Mr. S. E. Halliwell was unanimously elected President, with Mr. E. Berry as Vice-President; Mr. Braddock, Treasurer; Messrs. W. Baxendale, H. Smith, R. H. Garlick, E. Berry, L. G. Barber, and W. Hill, members of the Council; Messrs. E. Fearor and J. Wargham, Auditors; and Messrs. E. J. Wellens and F. Oldfield were re-elected Secretaries.

Mr. BARBER proposed a vote of thanks to the retiring President, who, as they all knew, had done everything in his power to promote the efficiency and the success of the Association.

Mr. CRITCHLEY seconded the proposition, which was most heartily and unanimously accorded.

The PRESIDENT, in responding, said that while he fully appreciated, and most sincerely thanked them for, the vote they had just passed, he thought their thanks were due more to those who had taken the largest share in the work of the Association; and he begged to propose a vote of thanks to the Council and to the other officials of the Association.

This proposal having been enthusiastically adopted,

Mr. GARLICK, in responding, said the various officials had done their best; and, from the result shown by the annual report, he was glad to see their efforts had not been unsuccessful.

Mr. E. J. WELLENS also responded on his own behalf and for Mr. Oldfield, from whom he had, he said, received most efficient assistance.

Prior to the meeting, the members spent the afternoon visiting the Salford Corporation Electricity Works, where, in the absence of Mr. Tait, they were received by the Works Engineer, who explained the plant and the various arrangements for the generation and transmission of electrical power; and afterwards, at the invitation of Messrs. Keith, Blackmore, and Co., they were afforded the opportunity for an examination of their gas compressors used for intensified gas lighting.

WATER SUPPLIES AND RIVER POLLUTION.

Conference in London.

On Wednesday and Thursday of last week, a Conference was held at St. Andrew's Hall, Newman Street, W., under the auspices of the Council of the Sanitary Institute, to consider the subject of water supplies and river pollution. The various sanitary authorities of the country were invited to send delegates to the meetings; and the result was a very full attendance of gentlemen interested in the question of water supply as viewed from one or other of its various aspects.

No less than fifteen papers were submitted to the conference; and it was wisely decided to take these as read, in order that the whole of the time at disposal might be devoted to discussing the different points raised in them. We shall, as opportunity offers, publish abstracts of the papers, together with a report of the discussions thereon. The communications submitted were of an extremely interesting character. On the first day, the papers by Mr. J. Parry, M.Inst.C.E., on "The Protection of Watersheds," by Dr. Seaton on "The Protection of Underground Sources of Public Water Supply," and by Mr. Clayton Beadle on "The Rights of Underground Pumping in relation to Flow of Neighbouring Streams," were taken together; and the result was a full and valuable discussion. Indeed, this part of the proceedings occupied so much time, that the Chairman was compelled to ask the speakers on the remaining papers to be taken at the sitting to be as brief in their remarks as possible.

The other papers discussed on the first day were: "Rainfall and Population of England and Wales in Relation to Water Supplies," by Dr. Mill; "The Desirability for Reports on the Water Supply of Each County," by Dr. Greenwood; "The Rivers of Glamorganshire, with remarks on the Rivers of Adjacent Counties," by Dr. Williams; "Water Supply to Isolated Cottages and Small Groups of Cottages," by Dr. Thresh; and "Village Water Supplies," by Miss C. Cochrane.

On the following day, Thursday, the first three papers on the *agenda*—namely, "Water Supply and River Pollution," by Professor Henry Robinson; "The Control of Weirs and Dams on Streams in Relation to River Pollution," by Mr. A. G. Leigh; and the "Prevention of Pollution within the Thames Watershed," by Mr. H. W. Russell—were discussed together, and proved most profitable subjects. The other communications considered at the sitting were: "Thames Water Supply and Storage," by Mr. H. W. Russell; "A Note with Reference to Water Standards," by Mr. H. R. Kenwood; "The Purification of Water," by Dr. S. Rideal; and the "Value of Soft Water," by Mr. F. Verney.

It had been announced that, on the opening day, the chair would be occupied by Sir Alexander R. Binnie, M.Inst.C.E.; but owing to the bereavement recently sustained by him, he was unable to be present. His place was taken by Professor HENRY ROBINSON, M.Inst.C.E., who opened the proceedings with a few

INTRODUCTORY REMARKS.

The CHAIRMAN commenced by offering a most cordial welcome to those present. He said it was felt that the large number who had responded to the invitation, indicated that the object of the conference was appreciated by those interested. He recalled the fact that he took part in a conference a quarter of a century ago, at the Society of Arts, at which resolutions were come to, and many of the points being brought forward to-day were discussed. All these years had elapsed, and they were practically in very much the same position now as then. Take the question of river pollution, the conservation of flood waters, or the better preservation of watersheds—but little had been done. He could call to mind the fact that all these years ago a proposal was made to deal with watersheds upon the principle of constructing impounding reservoirs, so as to enable the excess of rainfall to be utilized, by which means also a more uniform flow of streams would be produced. The incidence of taxation was brought forward as a difficulty; and, as a matter of fact, opposition arose on the part of owners of land on the high ground, to contributing towards the cost of the construction of works for the benefit of the inhabitants of the low lands. Indeed, it was suggested that the proprietors of the table-lands, rather than be taxed, should receive a payment, inasmuch as their lands were a means of collecting rainfall which they did not want, and which was utilized for the benefit of the community at large. In the paper which he had contributed to the present conference, he had dealt with the question of storing flood water, and also with the various matters in connection with river pollution. He could have enlarged upon these points; but, as Chairman, he thought it better to leave the paper to be discussed in the ordinary course. They might summarize the main points they were going to consider under two heads—the necessity for preserving the purity of rivers, and the necessity for conserving their watersheds.

AN INTERRUPTION.

Shortly after the commencement of the first discussion,

Mr. BELSHAM, who stated that he was a Poplar representative, rose and said he desired to move a resolution.

The CHAIRMAN remarked that Mr. Belsham had spoken to him; but he did not think the matter to which this gentleman desired to refer could properly come before the meeting. He did not say

that he did not sympathize with Mr. Belsham, but that it was not competent for them to deal with a specific case like that.

Mr. BELSHAM said that this was an important conference; and the matter he wished to bring forward was a very important one for East London. He himself was a sufferer from the pollution of the River Lea. He felt bound to enter his protest. They had had diphtheria, and now they had smallpox; and he thought it was the duty of a public man to protest against the water that was supplied to them. He concluded by producing a bottle containing a very black looking fluid, which he said was the "stuff" they had in East London.

RESOLUTIONS.

At the close of the discussions on the first day's papers,

The CHAIRMAN announced his intention to put to the meeting four resolutions, of which notice had been given.

Alderman BLOOR (Birkenhead) thereupon asked whether such a course of procedure was in order. It was not usual, he said, for a congress to pass resolutions of which previous notice had not been given. His position was that he had attended the meeting to listen to such discussion as might take place upon certain papers; but he was not aware that any definite resolutions of a committal character would be proposed. Consequently, he had not had any opportunity of giving attention to this aspect of the matter. One of the resolutions had reference to the conferring on County Councils of extended powers. This might or might not be a proper course; his point was that no notice had been given of the resolutions.

A DELEGATE (speaking from the gallery) pointed out that the members had had sent to them the clearest possible notice of the matters which were coming before the conference. He contended that it was reducing meetings of this kind to a mere absurdity, if they were told that they were to come and discuss papers, every word of which they had read, but that they were not competent to express their views by resolution.

The CHAIRMAN remarked that, had he not felt quite sure that he was in order, he would not have proposed to put the motions to the meeting.

Mr. STEER moved, as an amendment, that the resolutions be referred to the Council of the Sanitary Institute for consideration. Then, if the present meeting was to be the forerunner of periodical gatherings of this kind, in a year's time they might have brought before them something that they could unanimously adopt. It was a national matter, which could only be dealt with properly by the nation at large. He was quite of opinion that Parish Councils could do much, and County Councils could do much; but seeing that the least populated half of the country had the largest rainfall, it appeared to him that it was essentially a national matter.

The amendment having been duly seconded,

The CHAIRMAN pointed out that any resolutions passed by the meeting would go to the Council of the Sanitary Institute, and would not constitute a public manifesto of any kind.

The amendment was then put to the vote and defeated.

The CHAIRMAN next proceeded to read the four resolutions which had been proposed. They were as follows:—

By Mr. W. J. BURGESS (Liverpool)—

That, in the opinion of this congress, the purity of water supplies throughout the country can only be effectively secured by placing such supplies in the hands of representative bodies directly responsible to the consumers.

By Mr. J. SIDDALLS (Tiverton)—

That it is, in the interests of the kingdom at large, absolutely necessary that the County Councils should have large powers of supervision and control in respect of the question of water supplies in their respective county areas.

By Dr. HODGSON (Cheshire County Council), in reference to Dr. Greenwood's paper—

That the Council of the Sanitary Institute be asked to urge County Councils to investigate the existing condition of the water supplies within their districts, with special reference to the quality and quantity of such supplies; that the real or probable contamination of springs, wells, and streams used for potable purposes should be particularly noted, with chemical and bacterial analyses; and that attention should also, if possible, be directed to such additional or improved sources of water supplies as may be provided at a reasonable cost.

By Mr. J. PARRY, M.Inst.C.E. (Liverpool)—

That in the opinion of this conference legislation is urgently required for the better preservation of the water supplies of the country by amending the provisions of section 61 of the Water-Works Clauses Act, 1847, and by making procedure under the Rivers Pollution Act, 1876, more rapid and effective.

The first three of these resolutions were carried; but the fourth (that of Mr. Parry) was lost.

VOTES OF THANKS.

Sir F. Sharpe Powell, M.P., in proposing a vote of thanks to Mr. William Whitaker, F.R.S., who presided over the conference on Thursday, said they were under an obligation to the Chairman for having devoted his time to them. On many occasions he felt it was an act of supererogation to pay a compliment to a Chairman, because meetings were apt to regulate their own proceedings. But that day there had been times when firmness was required on the part of their Chairman, to prevent the meeting from degenerating into disorder. They were indebted to him for the skill with which he had guided the proceedings, and for the eminent success which had attended the exercise of that skill. It had been to him (the speaker) a most interesting and valuable discussion. He thought the debate had shown the great ability and the great knowledge which was being brought to bear upon the solution of a most difficult problem; and he felt that an important step in advance had been made, and that those who watched the proceedings from an unscientific point of view would have great confidence in the ultimate success which would attend the efforts that were being made to settle a most troublesome, but at the same time a most important, group of questions.

Mr. BURGESS seconded the motion, which was agreed to.

A cordial vote of thanks was also passed to the contributors of the various papers presented for consideration by the congress.

Visits to Works.

THE NEW RIVER COMPANY'S FITTINGS-TESTING WORKS.

On Wednesday afternoon, a large number of the delegates were conveyed in brakes to the testing-works of the New River Company, in Rosoman Street, Clerkenwell, where they had an opportunity of inspecting the arrangements made by the Company for the testing and stamping of water-fittings. This is by no means a new branch of their business; it having been started in 1883, when the general adoption of the constant supply rendered necessary more careful attention to the media by which it was furnished. At that time, the whole of the business was carried on in a room less than 12 feet square, or about the size of the office of the present Superintendent of the department (Mr. J. H. Norton). The testing work is not confined to the Company's district, but may be said to extend all over the country, and even beyond it. Makers desirous of having their fittings tested and stamped by the Company have to comply with a set of regulations which have been drawn up. They furnish the fullest particulars, and include the scale of charges, which range from 2d. up to 7s. 6d. Manufacturers have to submit samples made in accordance with the regulations; and on these being approved by the Company's Distributing Engineer (Mr. Ernest Collins, M.Inst.C.E.), they are placed in the sample-case, and all fittings submitted must be equal in quality to the pattern—a condition which is found to be generally observed. When there is any marked deviation from the pattern or the regulations, no attempt is made to put the appliance through the test. It is simply rejected. All fittings which, when in use, will be subject to pressure, have to be capable of resisting a force of 300 lbs. per square inch; while ball-valves must shut off under a pressure of 100 lbs. The extent of the Company's operations in this department may be estimated by the fact that, on an average, 500 flushing-cisterns and from 4000 to 5000 taps are tested per week.

The building in which this important work is carried on is a spacious and well-lighted brick structure, some 70 feet long and 35 feet wide, consisting of two floors, connected by iron staircases, with an acid chamber in the roof. It stands within the Company's boundary wall, and is admirably fitted up with the special plant required. Power is furnished by a 12-horse power gas-engine; and water is laid on at pressures ranging from the ordinary 50 lbs. on the mains up to 300 lbs. per square inch. Goods are delivered at a large opening at one end of the building, and their reception acknowledged on a printed form, which is exchanged for a priced invoice before their removal. The ground floor of the building is devoted to the heavier testing work, such as that of flushing-tanks of various sizes; while on the upper floor, which is divided into two shops, the brasswork is dealt with, and meters are repaired and tested. The tanks, which bear some distinctive mark, are ranged upon a wooden frame and connected with the water service. If they stand the test, they are removed to a bench at which the Company's stamp is affixed. Very great attention is paid to the testing of taps. In the first place, they are weighed, and then taken to pieces in order to ascertain whether or not they conform to the regulations; and their constituent parts, as well as the screw-threads, are all systematically measured by the standard steel gauge kept upon the premises. Opportunity is thus afforded for comparing them with the pattern in section submitted by the makers. Having passed this scrutiny, they are subjected to the pressure test; care being taken by the operator to test the pressure on both sides of the valve by partially obstructing the outlet, and thus checking the flow of water. There is probably no part of a consumer's water-fittings which is more likely to give him trouble than the ball-valve in his cistern. Those approved by the New River Company are of copper, fitted with a brass stud to screw on to the lever. They specify that this stud must not be drilled through, as a plumber is liable to screw the lever in too far, and perforate the ball. This is so balanced on the lever that the rim of solder joining the two halves is always above the water-level, and therefore it cannot be affected by any acid there may be in the water. As already mentioned, ball-valves must shut off under a pressure of 100 lbs. per square inch. This test they almost invariably stand; in fact, it is not until the gauge indicates 120 lbs. that slight leakage begins to show itself. The balls are tested for soundness by immersion in hot water, when the existence of the most minute defect in the metal is at once shown by the air bubbles produced.

The foregoing and other details as to the work of the station were furnished to the visitors by Mr. Collins and Mr. Norton. One could not listen to them without reflecting that the Company

and their officials are making a determined effort to ensure good work in the matter of water-fittings. That they are being supported is evident from the fact that, though the fees are by no means high, the amount received from outside sources is sufficient to make the department pay for itself. It is to be wished that the visit of the delegates may result in a still wider demand for its valuable assistance.

The East London Water-Works at Lea Bridge.

On leaving the testing-shops shortly after three o'clock, the party were driven to the Lea Bridge works of the East London Water Company, where they were able to appreciate the extent of the pumping and filtration plant required by only one of the eight London Water Companies at but one of their stations. At Lea Bridge there are no less than 25 filter-beds, occupying an area of 24 acres, or, on an average, rather less than an acre each. The water to supply them is brought from Walthamstow, where there are ten reservoirs, with an aggregate water area of about 320 acres, by means of a broad open channel. These reservoirs receive the water drawn from the Lea at the Company's intake at Ponder's End. Two deep wells have been sunk into the chalk at Lea Bridge, and something like 7000 feet of tunnelling has been driven in various directions under the Company's property. From this source a considerable quantity of water of great purity, and consequently not requiring filtration, is procured. During their progress through the works, the delegates had an opportunity of witnessing the process of scraping the bottom of a filter. The pumping plant presented to them in a very striking way the results of practically half-a-century's progress in this department of mechanical engineering—the earliest engine dating from 1854. It is of the Cornish type, and was built by Messrs. Harvey and Co. Its pump is 50 inches in diameter, and its delivering capacity 1500 cubic feet, or about 9400 gallons, per minute. A twin pair of engines of this type, each having a pumping power of 1100 cubic feet—say, together, 14,000 gallons—per minute, were put up by the same firm in 1867. An addition was made to the plant eleven years later, when Messrs. Simpson and Co. erected two compound rotary engines, each equal to delivering about 2100 gallons per minute. These were followed, in 1886, by a compound horizontal engine, of rather larger capacity, supplied by Messrs. Mather and Platt. Considerable development of the pumping plant took place in 1891, when Messrs. Yates and Thom erected three triple-expansion marine engines, each capable of lifting about 8750 gallons of water per minute. Messrs. Harvey and Co. followed, three years later, with an engine of this type of the same capacity. Messrs. Hathorn, Davey, and Co., who had previously supplied the Company with a compound engine to actuate a well-pump, received an order last year for a triple-expansion engine of rather larger power for a like purpose; while Messrs. Simpson and Co. put up one of the same type, capable of lifting 7000 gallons per minute. All this plant has recently been supplemented by a pair of Worthington pumps (for which a special house has just been erected), actuated by four Babcock and Wilcox boilers. Then, in addition to the steam pumping-engines, there are two 45-inch Hercules, and two 72-inch Giard turbines; the former built by the Holyoke Machine Company, and the latter by Günther, of Oldham. In their inspection of this interesting collection of plant, the visitors were assisted by a few particulars prepared by the Company's Chief Engineer, Mr. W. B. Bryan, M.Inst.C.E., who was unable to personally conduct the party over the works. His place was, however, well supplied by Mr. Bryan, jun., and Mr. Ashley, who courteously furnished whatever additional information was sought. Unfortunately, the weather was not very favourable for the visit; nevertheless, it cannot fail to have been most instructive to those who were sufficiently unmindful of the elements to participate in it.

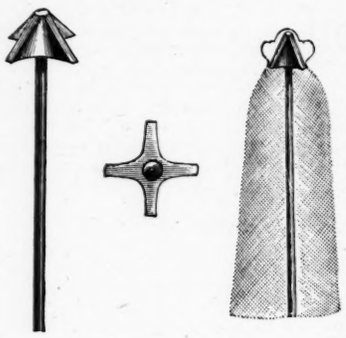
The Staines Reservoirs.

On Thursday afternoon, about 140 of those who had attended the meetings paid a visit of inspection to the Staines Reservoirs. They travelled by special train to Staines, where conveyances were in readiness to convey them to the works. On arrival, they were met by Mr. R. E. Middleton, M.Inst.C.E., who conducted the party round. The works, which appear to be now nearing completion (though it was stated that at least another twelve months will elapse before they are quite finished), were greatly admired; and it was generally agreed that the site was an ideal one for the construction of such reservoirs, on account of the great depth of clay beneath it. The scheme has already been so fully described in our pages, that it is unnecessary to again give any of the details as to it. At the conclusion of the visit, Mr. Whitaker proposed a vote of thanks to Mr. Middleton for so kindly showing and explaining to them all that was to be seen. He said they had that day had the pleasure of inspecting some of the largest works of the sort in England. They would remember that these reservoirs were the outcome of the Balfour Commission on the Metropolitan Water Supply. The original designers were Mr. Fraser, then Engineer to the Grand Junction Water Company (who, however, did not live to see more than the commencement of the work) and Mr. Walter Hunter; and the undertaking had been carried out by the latter gentleman and Mr. Middleton. These reservoirs would solve a difficult problem. The Thames was not an ordinary river. It was impossible to make a dam across it anywhere; and even if they could do this in the higher part, it would be porous, and so would be of no use. The only thing was to construct these reservoirs, which had been done in the most admirable manner. They would solve the question at all events for a long time; and it could not be expected that they should provide for the requirements of all futurity. Mr. Middleton, in reply, said he regretted that Mr. Hunter was unable to be present with them that day; but he hoped that when the works were finished they would all come again and see them.

In connection with the conference, there was an exhibition of appliances in which those attending were likely to be interested. These chiefly related to drainage; and there were also many filters of different kinds. A very good show of water-works specialities was made by Mr. George Kent, who, besides his well-known "Absolute," "Uniform," and "Venturi" water-meters, exhibited drawings of an irrigation meter constructed to work practically without loss of head. There were also to be seen here Rodda's patent automatic apparatus for taking samples of water at any depth, and his self-locking surface boxes. Messrs. Fletcher, Russell, and Co. had on view the "Hurst" pipe joint and connection, which was described in last week's "Journal." The loan collection included some excellent drawings and models, lent by Mr. P. H. Palmer, Dr. Childs, Professor Corfield, the Bristol Water Company, the Reading Corporation, the Grand Junction Water Company, and Messrs. Hunter and Goodman. Mr. Percy Griffith lent a case of specimens of core from the deep-well boring at the Gainsborough Water-Works; and Alderman Gascoyne, of Richmond, a case of specimens taken from a bore 1400 feet deep from the surface to the red sandstone.

SUPPORT FOR INCANDESCENT MANTLES.

It will, we think, be readily acknowledged that one of the greatest drawbacks to the efficient action of an incandescent gas mantle is its inadequate support. Unless attention is given to the proper adjustment of the mantle, it is apt to sway about under the action of a strong wind, or the vibration caused by vehicular traffic, with the result that it will burn badly (thereby bringing the system into disrepute), becomes quickly damaged, and has its life considerably shortened. Many efforts have been made to obviate these defects; and among others who have turned their attention to the matter is Mr. W. G. Hicks, of the Gas Self-Lighting Company, Limited, who has devised the support shown in the accompanying illustrations. He has given to it the name of the "Firm," because he claims that, owing to the shape of the top, the mantle has a perfectly firm bearing which does not interfere with the current of gas passing through and cause blackening. A further advantage claimed for this support is that when it is used in conjunction with an anti-vibrator, movement of the mantle when the spring of this appliance is brought into action is entirely prevented. The Welsbach Company have had some of these supports, which are made to suit all sizes of mantles, in use, and have found them to act satisfactorily.



A RECUPERATIVE HIGH-POWER INCANDESCENT GAS-LAMP.

In the study of many of the new devices brought out for obtaining high results from incandescent mantles, considerable interest is found; and more especially is this so in the case of the various contrivances for raising the efficiency of street-lamps. For interior domestic lighting, there is no necessity for a light of very great intensity—in fact, in an ordinary room the application of lights giving anything more than (say) 60 candles from one burner, or centre, only results in distress to the eyes, and ultimately in a toning down of the brilliance by the employment of shades or tinted glasses. What is required for house lighting is the highest efficiency possible from a low consumption of gas. But in the case of street illumination and extensive and high interiors, intensity is an advantage; and the greater the illuminating power that can be obtained per cubic foot of gas from a single lamp without extravagance the better—that is to say, provided the means by which the high power is obtained does not cost too much for installation and maintenance. Of course, there are situations where even a little extravagance in securing the utmost effect is warranted. But for general street lighting, we have heard gas engineers debating among themselves as to whether the realization of a few extra candles per cubic foot of gas really justifies a somewhat considerable initial expenditure per burner.

Gas-lighting engineers seem to be recognizing the existence of this feeling; and their energies now appear to be directed to the

production of simple and comparatively inexpensive means of securing a respectable lighting value from the gas consumed. Messrs. A. E. Podmore and Co., of No. 25a, Hatton Garden, are among those lighting engineers who have recognized this; and they have now in their possession a lamp which does good duty, and which should not—the auxiliary parts that enhance the efficiency being of a modest character—cost such a sum over and above the price of a good and completely fitted lantern as would make its adoption at all prohibitive. The lamp is the patent of Messrs. Podmore and Thomas; and the main feature is that the inventors have in it applied the recuperative principle to incandescent gas lighting. If readers will refer to the illustration, they will readily see how this is accomplished. In the head of the lamp, above the reflector, is a chamber which surrounds the chimney; and air is admitted to this chamber from the interior of the lamp. Heat from the incandescent mantle passing through the chimney, of course, imparts great heat to it; and this, in turn, raises to a high temperature the air passing through the chamber. This heated air is the only supply which can find its way to the burner for forming the feeding mixture. The method by which it is conducted to the burner is also shown in the illustration. It will be seen that the descending tube taps the hot-air chamber towards its centre, and so is well removed from the cold-air inlets. In this way, the hot-air supply is maintained at an equable temperature.

The bottom of the burner, which is an encased No. 4 Kern, fits into a little tubular chamber, into which the hot air-supply pipe discharges. Into the base of this small chamber (which has a cavity of $\frac{3}{8}$ inch diameter by $1\frac{1}{4}$ inches deep) is screwed the gas-injector, which is detached from its ordinary position at the foot of the Kern burner. The apex of the injector is situated just slightly above the inlet for the hot air, which is drawn in and intensifies with the gas in its passage through the stem of the Kern burner. The intimate travel of the gas and air is, of course, slightly increased by the elongation of the stem by the addition of this chamber. The additional exterior casing of the burner prevents any air passing in through the ordinary inlets. The head of the burner is also supplied with an extra casing formed with a cone-shaped rim support for the glass. This support serves as a protector to the base of the mantle; preventing a direct upward current of air, and obviating, it is said, to a large extent the fraying and curling up of the mantle which is so noticeable in the case of unprotected mantles. The shape of the glass (which is registered) directs and sandwiches the current of air on to the exterior surface of the mantle throughout its full length.

Inspection of the lamp leaves little doubt regarding the powerfulness of the light secured by these means. When first ignited (which by the way is accomplished by a bye-pass) the air supply to the burner is perfectly cold; but by placing the hand on the air-supply tube, one is quickly convinced of the rapid rise from a cold to an unbearable temperature. With this increase of temperature, there is an apparent improvement in the incandescence of the mantle, and it follows in its light-giving power.

There are other little points about the lamp on which a word or two may be said. In the first place, a small peg will be noticed on the right-hand side of the illustration close to the burner, upon which peg the upper portion of the burner may be placed for safety during cleaning. This convenience will be appreciated by lamp cleaners. "Monopole" glasses are being made for the lamps. It is a very clear glass, and is credited with great heat-resisting quality. Then the air-supply pipe has a loose collar joint about midway in its length, for facilitating its occasional cleansing from any dust accumulating in it. Speaking of dust reminds us that the lamp struck us as being particularly appropriate to dusty localities and hot climates where winged insects are found to have a baneful effect on the life of mantles and the efficiency of the burners, as the construction enables the lantern to be perfectly air-tight, and secure against such intruders. The lamp is strongly made, and the lantern can be of any size, shape, or design; and the arrangement is equally applicable to clusters of burners as to single ones, and to any size of burner.

SUGG'S HIGH-PRESSURE INCANDESCENT GAS-LIGHTS.

A short time since, it was decided by the Bridge House Estates Committee of the Corporation of the City of London that the lighting of the Tower Bridge and Blackfriars Bridge should be much improved; and for this purpose they decided to adopt the high-pressure gas system, under Mr. William Sugg's patents. The City Architect and Surveyor (Mr. A. Murray) was instructed to make the necessary arrangements with the South Metropolitan, the Gaslight and Coke, and the Commercial Gas Companies, who lighted the parts of the bridges which come within their respective districts. The Engineers of each of the Companies co-operated to carry out the wishes of the Corporation; leaving the arrangements for the execution of the work to the South Metropolitan Gas Company.

The Tower Bridge was originally lighted by Messrs. William Sugg and Co. under Sir John Wolfe Barry, K.C.B., by means of specially made flat-flame burners; and Blackfriars Bridge was formerly lighted by the late Colonel Haywood, Engineer to the Corporation, with similar burners. The pressure of the gas supplied to the bridges by the Gas Companies mentioned is sufficient to balance a 2-inch column of water; and the light produced in each lamp was equal to about 15 sperm candles, with a consumption of 5 cubic feet of gas per hour.

Under the new system, the pressure of gas supplied by the Companies to the bridges will be increased from 2 to 10 inches at the foot of each burner. The burners used in each of the lamps on both bridges will be alike. They are a specially contrived form of bunsen burner, and made to secure the highest result in incandescent lighting. Their action may be popularly described as follows: The gas under the 10-inch pressure enters the governor at the foot of the burner, which regulates the exact quantity of gas to be supplied to it. The gas is delivered into the air-supply chamber of the burner through a small jet made of steatite. The gas then rushing in at a velocity of about 260 linear feet per second, draws in to the burner a volume of air, estimated to be about 70 cubic feet per hour to 10 cubic feet of gas per hour. This quantity of air is not sufficient to produce perfect combustion; but the mixed gas and air burning under the mantle produces (according to Mr. Sugg) a combination which exercises a very poweful attraction on the oxygen of the surrounding atmosphere. It causes it to part company with the nitrogen with which it is only mechanically combined, and, diffusing itself through the meshes of the mantle, meets with the heated mixed gas, and combining with it on the surface of the mantle, produces a very brilliant white light very similar to the oxy-hydrogen lime-light. The illuminating power produced for the 10 feet of gas is 300 candles nominal, or twenty times the amount of volume of light produced by the burners previously in use on the bridges.

The burners are enclosed in lanterns suitably ventilated to prevent the violent gusts of wind (which frequently sweep over the two bridges) injuriously affecting the mantles. The number of lamps on the Tower Bridge north and south are 66; and there are two large lamps with four burners in each, consuming an aggregate of 80 cubic feet per hour, and giving a light of 1200 to 1400 candles nominal each lamp. These are fixed on each side of the bridge facing the bascule, which is entirely lighted by means of these powerful lights. The aggregate volume of light to light the Tower Bridge on the new system is therefore equal to 22,200 candles nominal. The lamps on Blackfriars Bridge number 39; each burning 10 cubic feet of gas per hour, and giving a light of 300 candles nominal. The aggregate volume of light to light the bridge is therefore 11,700 candles nominal.

The pressure is raised on both bridges from about 2 to 10 inches by means of small hydraulic rams, working at 30 lbs. on the square inch water pressure from the Water Company's mains, and actuating double-action gas-pumps. Each of these is controlled automatically by means of specially devised governors, which regulate the supply of gas to the exact demand as the lamps are lighted up by the lamplighter, and diminish the supply as the lamps are turned out—stopping the apparatus entirely when the last one is turned off. These are placed on the Tower Bridge in two small chambers, one at each end of the bridge. At Blackfriars, only one is used, which is placed at the northern end of the bridge, because there is no break of continuity of the mains as there is at the Tower Bridge at the bascule.

For the purpose of steadying the lanterns, and lighting them up without opening the lanterns, the Chief Engineer of the South Metropolitan Gas Company (Mr. C. C. Carpenter) has devised a special arrangement, which fits solidly on the top of the lamp columns, and neutralizes to a considerable extent the vibrations caused by the passage of the heavy traffic over the bridges. Each of the burners is also provided with a sensitive anti-vibrator, which keeps the mantles from being jarred by the constant tremor of the bridges to which they would otherwise be exposed. The lamplighter merely uses a light wooden rod with which to turn the lever arranged in the cradle carrying the lamp. This causes a little flash-jet to light up the burner; and the same lever, moved in another direction, puts out the lamp.

The lamps were lighted up experimentally on Saturday; and last evening they were brought into ordinary use, when an inspection was made by the Bridge House Estates Committee. It is to be hoped a good impression was made.

CORRESPONDENCE.

[*We are not responsible for opinions expressed by correspondents.*]

Standardizing Meter-Unions.

SIR,—I beg to inform you that, in pursuance of the resolution passed at the annual general meeting of the Gas Institute in June last, a conference with the Council on the above subject was held on the 25th of July—representatives of the Institution of Gas Engineers, of the North British Association of Gas Managers, and of meter manufacturers being invited to attend. The following resolution was unanimously passed at this conference, on the proposal of Mr. J. W. Helps, seconded by Mr. W. Carr:—

"That the set of meter-unions now in possession of the Board of Trade be recommended for adoption as the standard set; that the Board of Trade be requested to authorize the adoption of this set; and that an endeavour be made to arrange for an official pronouncement on the matter at the forthcoming Engineering Congress at Glasgow, Sept. 3 to 5, 1901."

As it was not possible to get the matter advanced sufficiently by the date of the congress, no referenee was made to it then.

A communication has now been received from Mr. H. J. Chaney, the Superintendent of Weights and Measures of the Board of Trade (Standards Department), stating that the set of standard meter-unions has been measured and verified, and enclosing a note of the actual sizes of these "Standard Gas-Meter Union Gauges, 1901," which are as given below.

I have only to add that the gauges have been engraved by the Board of Trade with a mark of verification, and are in their possession at the Standards Department.

WALTER T. DUNN,
Secretary, Incorporated Gas Institute.

39, *Victoria Street, S.W.*,
Oct. 18, 1901.

[ENCLOSURE.]

Actual Sizes in Inches and Parts of an Inch of Standard Gas-Meter Union Gauges, 1901.

Denomination. No. of Lights.	Diameter. Inches.	Depth of Thread. Inch.	Pitch.
80—100	3·018	0·057	11
60	2·448	0·057	11
50	2·250	0·057	11
30	2 052	0·058	11
20	1·820	0·057	11
10	1·451	0·057	11
5	1·153	0·055	12
3	0·986 ±0·002	0·036	18

The pitch varies ± 0·002 and 0·003 inch.

Dimensions of Inside of Screw-Plug.

No. of Lights.	Inches.	No. of Lights.	Inches.	No. of Lights.	Inch.
80—100	2·31	30	1·56	5	0·82
60	2·01	20	1·41	3	0·67
50	1·76	10	1·06		

± 0·001 inch.

Note.—The above sizes are the actual measurements of the minimum diameter of "boss" opening to admit "short shank of lining."

Standards Department, Oct. 10, 1901.

Remuneration of Labour.

SIR,—The article in this week's "JOURNAL" on the "Remuneration of Labour," contains the following reference to our profit-sharing system: "We must reserve the liberty of criticizing the semi-compulsory operation of the scheme, on the ground that it measures up all the virtues of the workman by the single standard of thrift." The following sentences amplify the idea; and much the same was said in an article in the "JOURNAL" some months ago.

I have no desire to occupy your space to prove that I think the writer of the article is mistaken on both points; for he evidently misunderstands some important necessities of the working of our system. I write, however, because I feel that any disparagement of thrift by the "JOURNAL," which is largely read, and deservedly looked up to, by many gas workmen, is calculated to do harm rather than the good which the "JOURNAL" endeavours to promote.

GEORGE LIVESEY.

Oct. 18, 1901.

Mr. Brown's Presidential Address before the Eastern Counties Gas Managers' Association.

SIR,—I have read with much pleasure Mr. Brown's Presidential Address before the Eastern Counties Gas Managers' Association at Cambridge—especially the portion relating to the use of mechanical appliances as adopted in gas-works in this country.

Mr. Brown expresses the opinion that the electrical engineer more readily adopts the mechanical up-to-date methods of transmission of material than does the gas engineer. Mr. Brown further refers to, and gives illustrations of, plant which has been adopted at the Newport (Mon.) Electricity Works, which he considers to be a suitable coal and ash conveying plant, described as the "gravity-bucket tilting-conveyor."

It will no doubt interest Mr. Brown and many of your readers to learn that one of these gravity-bucket tilting-conveyors and elevators can be seen in operation at these works, in conjunction with an inclined installation of retorts just completed by Messrs. Jonas Drake and Son, of Halifax.

It is intended that an illustration of the plant, together with a communicated article, shall appear at an early date in the Technical Press.

ROBERT PORTER.

Elland Gas-Works, Oct. 11, 1901.

LEGAL INTELLIGENCE.

COURT OF SESSION.—Wednesday, Oct. 16.

(*Before Lord* KYLLACHY.)

Welsbach Litigation in Scotland.

His Lordship to-day heard Counsel in an action by the Welsbach Incandescent Gaslight Company against David M'Mann, carrying on business as the Incandescent Fitting Company, at No. 241, George Street, Aberdeen, and his wife. The complainers seek to have the respondents interdicted from infringing their 1893 patent—the validity of which, they say, has been judicially certified—by the manufacture, use, hire, or sale of mantles made according to the specification of the patent. Six mantles were purchased from the respondents and analyzed. The contents were about 99 per cent. of oxide of thorium, 0·90 per cent. of oxide of cerium, and the balance of lime and magnesia. The complainers held patents dated in 1885 and 1886, both of which, they say, are now expired. During the subsistence of these patents, David M'Mann was ascertained to be infringing them, and was interdicted in July, 1898. In May, 1899, he was charged with a breach of interdict; and having been found guilty, was sent to prison for two months from May 16. It is complained that he is still dealing in mantles which had been patented by the Company; his wife being associated with him. In defence, the respondents maintain that the patent of 1893 is invalid, because it was anticipated by the complainers themselves having, in 1891 or 1892, manufactured and sold mantles composed of oxide of thorium and oxide of cerium in the proportions set forth in the patent of 1893. They therefore deny that there has been infringement of the patent by them.

Mr. CLYDE, K.C., for the complainers, moved for a proof of their averments.

Mr. D. ANDERSON, for the respondents, moved that the application be dismissed as irrelevant.

Lord KYLLACHY said he could not deal with the case except upon the footing of the usual assumption that letters patent required to be construed by experts, and that no judge would take the liberty of construing a patent, whether or not he knew something of the subject-matter of it. It was always, he thought, decided on after the parties had had an opportunity of leading expert evidence of, among other things, the true construction of the patent. When he said true construction, he meant true construction so far as affected by a prior state of knowledge and the exposition of technical terms. Even if he were satisfied, from the argument, that there had been anticipation of the patent, he did not think he could give effect to that fact without allowing proof on the other side; but he must say that, so far as he had an impression on the subject, he did not quite see how to draw an inference from the fact that a mixture of a very small proportion of cerium was an infringement of the patent of 1886. The question was whether the mixture of thorium was so described in the patent of 1886 as to form a good anticipation of the patent of 1893. The test of infringement was whether the claim covered the specification—whether the description of the patent was sufficient to enable a workman of ordinary skill to perform the work that was prescribed in the invention. He must allow proof in the usual way.

It was stated that the proof would be little more than the examination of a couple of experts.

LEEDS QUARTER SESSIONS.

Thursday, Oct. 17.

(*Before Mr.* E. TINDAL ATKINSON, K.C., *the Recorder.*)

The Disclosure of Trade Secrets.

To-day the trial commenced of Charles Duncan, mechanic, who was charged with stealing eight acetylene gas-burners, twelve dies, six test burners, a slit-union hollowing tool, and other goods and appliances, the property of Messrs. George Bray and Co., of Leeds, on March 28 last (see *ante*, pp. 288, 454).

Mr. R. D. MUIR and Mr. A. W. BAIRSTOW prosecuted; Mr. J. A. COMPSTON appeared for the prisoner.

Mr. MUIR, in opening the case for the prosecution, said that for many years Messrs. Bray had in their employ a man named M'Culloch, who was a foreman, and who acquired considerable knowledge of the process by which the firm carried on their business. The prisoner was engaged about three years ago as a mechanic, and afterwards as a repairer and adjuster of certain machines used for the making of gas-burners with porcelain tips. M'Culloch left the firm in August last year on account of ill-health; and Duncan left in March of this year after having been refused an advance of salary. When entering the firm's employ, he was definitely given to understand that anything which he saw or learned while on the works was absolutely private, and must not be divulged to anyone outside or in another department of the works. Shortly after he left Bray's employ, it was found that Duncan had taken a small shop, where he commenced the manufacture of burners, with appliances which were either stolen from Messrs. Bray, or had been copied by means of the knowledge the prisoner had acquired while in their employ. Some letters found made it clear that the prisoner had been engaged, not merely in the manufacture of burners and betraying his master's secrets, but in a conspiracy with M'Culloch to get somebody to steal materials from Messrs. Bray.

Mr. COMPSTON protested against allegations of conspiracy being made. There was absolutely nothing in the indictment to justify the suggestion.

Mr. MUIR (continuing) stated that on the floor of the prisoner's workshop was discovered a letter torn in fragments addressed to M'Culloch, and asking him to obtain various articles used in the manufacture of gas-burners. The letter contained the words: "Don't run any risk."

Upon reading this letter, Mr. Bray obtained a search warrant, and examined the prisoner's room at his lodgings, and also the room where he was then employed at the works of Messrs. J. Milne and Son, who were rival manufacturers to Messrs. Bray, and whom he was enabling to make burners exactly similar to those made by Messrs. Bray. The search resulted in the discovery of the articles mentioned in the indictment, as well as pieces of Messrs. Bray's secretly manufactured clay, and machines, parts of machines for making porcelain tips, and several plans and tracings of a great portion of their machinery.

Mr. *George Bray* gave evidence, at considerable length, in support of Counsel's statement. In cross-examination, witness denied that the defendant was in the habit of making experiments which might be useful. The things in question would be simply invaluable to a rival firm. With these articles and the plans, a clever man would be able to make his burners.

Mr. *W. D. Helps*, a Director of Messrs. J. Milne and Son, deposed to the prisoner having been engaged by the firm as a gas-burner maker. They agreed to take over his plant, which included two machines, for £55. Witness had not the slightest idea that the machines were of the same type as Messrs. Bray's, or that the prisoner was handing over the secrets of that firm.

The RECORDER: There does not seem to be the slightest reflection upon Messrs. Milne in this transaction.

Prisoner then gave evidence. He stated that he entered Messrs. Bray's service in February, 1898, and left in March last. He had been constantly experimenting. Nearly three years ago, he designed and made a complete acetylene gas-generator. Some of the acetylene burners found in his possession were his own make; others had been given to him to experiment upon. He made burners, and got them on the market; but having reached the end of his capital, he entered the service of Messrs. Milne. Several articles identified by Mr. Bray as his were described by witness as things from the scrap heap, and absolutely useless. He had none of Messrs. Bray's clay. What he had, he had made himself from different materials. The dies produced were Messrs. Bray's, made by himself (prisoner); but those in use on his machines were different. Whatever articles had been found in his possession had either been given him for experimenting, or had been inadvertently taken away in his smock pocket, in which they had been put in the course of his work as a mechanic.

Friday, Oct. 18.

Mr. MUIR, in summing up the case for the prosecution, said the question to be considered was whether the articles were taken with felonious intent. He submitted that they were only taken as patterns, whereby goods like those made by the prosecutor might be placed upon the market.

Mr. COMPSTON contended that the articles alleged to have been stolen were mere trifles, and that the prisoner had put them into his pocket while at work, in the same way that other workmen throughout the city were in the habit of doing. There was no felonious intent; and it was through the letter which the prisoner had sent to Mr. Bray, that inquiries were instituted. Duncan had spent his time experimenting on articles for the benefit of his employer; and he had been rewarded by being placed in the dock.

The Jury, after deliberating for two hours and a half, found a verdict of "Guilty," with a recommendation to mercy.

The RECORDER said he had intended to deal severely with the prisoner; but in view of the recommendation of the Jury, he would only pass a sentence of nine months with hard labour.

NORTHAMPTON QUARTER SESSIONS.

Friday, Oct. 18.

(*Before Mr.* E. P. MONCKTON, *Recorder.*)

Northampton Gas Company v. The Assessment Committee of the Northampton Union.

Judgment was to-day given on the appeal by the Northampton Gas Company against the assessment of their works and mains in the parish of All Saints, Northampton. The case was heard the previous sessions, and was fully reported in the "JOURNAL" at the time (*ante*, p. 398).

Mr. C. LACEY SMITH represented the Company; Mr. B. CAMPION appeared for the Assessment Committee.

The RECORDER said he had been through the voluminous notes with as much care as he possibly could; and he thought it was about the most difficult case of figures he had had to deal with. The old assessment was £2060 gross, and £1860 rateable. The difference between the two, he could hardly understand; it was so very inconsiderable. The appellants were prepared to accept as the new assessment £4242 gross and £2908 rateable; but the new assessment by the Committee was £6488 gross and £4732 rateable—an increase on what the appellants were prepared to accept of £2606 gross and £1824 rateable. Taking everything into consideration—not merely the statutory amount which could be paid away to the shareholders—his decision was that the gross value should be £6242 and the rateable value £4115. He had not considered any parish except All Saints; but he thought the amounts in other parishes might be easily computed from the figures of the judgment. He would not object to granting a case on the point as to whether he could assess beyond the statutory amount which could be returned to the shareholders.

A discussion ensued as to costs; and the Recorder awarded costs to the appellants, to be taxed out of sessions.

Alleged Slander by a Resident Gas Engineer.

In the Court of Session, Edinburgh, last Wednesday, Lord Kincairney closed the record and ordered issues for trial by jury of an action by Alexander Forbes, jun., a contractor, of Edinburgh, against Harry H. Gracie, in which the pursuer sues for £1000 as damages for alleged slander. The pursuer is a mason in Edinburgh, and one of the contractors engaged in the construction of the gas-works at Granton. The defender is the Resident Engineer at the works. The pursuer states that for some time the defender, without any cause, has acted from a spirit of ill-will towards him. On July 17 the defender instructed his foreman mason to request the use of a crane which the pursuer had erected at considerable expense; and the pursuer intimated that, on paying half the expense of putting up and taking down the crane, he might have the use of it. Without the pursuer's authority, the defender caused his men to use the crane next morning. Thereupon, to prevent further use, the pursuer removed the handles. On July 19 the defender instructed his foreman to demand the handles from the pursuer, under threat of calling in the police. The pursuer refused to part with the handles; and thereupon, it is stated, the defender caused a police constable to be brought. The pursuer still declined to part with the handles; and the foreman, acting, it is said, on the instructions of the defender, said to the policeman: "Now you know what to do." The policeman, however, declined to arrest the pursuer, without instructions from his own superiors, on a charge of theft of the handles. In causing information to be sent to the police, and requesting them to apprehend the pursuer on such a charge, the pursuer says the defender acted maliciously and without probable cause, and that he was well aware there was not the slightest pretext for such an imputation. The sum sued for, he says, moderately represents his loss and damage caused by the conduct of the defender. The defender denies the pursuer's statements, and explains that the crane was supplied to the pursuer by the Commissioners, and the use he proposed to make of it was within the right of the Commissioners under their contract with the pursuer. In removing the handles of the crane, which were the property of the Commissioners, the pursuer acted unwarrantably and illegally. The defender says he acted throughout without malice and in the *bonâ fide* execution of what he believed to be his duty to his employers. [The Gas Commissioners have agreed to defend the action.]

The Charge of Stealing Gas.

At the West London Police Court on Saturday, before Mr. Rose, Henry Valentine Mendelssohn Hill, who carried on the business of a hairdresser and tobacconist, in Wandsworth Bridge Road, surrendered to his bail to answer the charge of stealing 50,000 cubic feet of gas, value £8 10s. 10d., the property of the Gaslight and Coke Company. The previous proceedings were reported last week (p. 979). Mr. Humphreys again appeared to prosecute; and Mr. Harnett defended. The allegation was that a separate connection had been made to allow the gas to pass outside the meter for the lights, and to work an engine for generating electricity. Additional evidence was given, showing that since the 1st of October the illumination of the shop had dropped 50 per cent., whereas previously it had been brilliantly lighted. His Worship having expressed his intention of submitting the case to a jury, Mr. Harnett said that he would not pursue the cross-examination or call any witnesses. The prisoner was committed for trial, bail being allowed.

Bradford's Application to Parliament Next Session.—A special meeting of the Bradford City Council will be held next Tuesday to decide upon the promotion of a Corporation Bill in the ensuing session of Parliament for the following (among other) purposes: The purchase of the undertakings of the Clayton, Allerton, and Thornton Gas Company, the Airedale (Idle) Gas Company, and the Eccleshill and Bolton Gas Company—subject to possession by arbitration.

Quality of the London Water Supply.—The report for September of Sir William Crookes and Professor Dewar on the composition and quality of the water supplied to London during that month, sets forth that 200 samples of water taken from the mains of the Water Companies were analyzed, all of which were found to be clear, bright, and well filtered. Of 444 samples of impounded and filtered water supplied to London and examined bacteriologically, 32 samples, or 7·4 per cent., were sterile. Not one sample contained as many as 150 microbes; while only eight samples, or 1·8 per cent., contained more than 100 microbes, per cubic centimetre, thus showing the remarkable purity of the supply during the month. The mean number of microbes in the eight excess samples was 118, against a corresponding mean of 212 in six excess samples during August.

Flood Damage at the Saltley Gas-Works.—The Birmingham Gas Committee, at the meeting of the City Council to-day, will report the amicable settlement of all claims arising out of the floods which occurred at Nechells works at the time of heavy rainfall on Dec. 31 last. It will be remembered that so great was the volume of water coming through and over the training walls of the River Lea, which passes through the Nechells works, that the boundary wall of the works, adjoining the bank of the Birmingham and Warwick Junction Canal, was swept away, and the water entered the canal in such quantity as to occasion the bursting of the canal bank at a point opposite the works of Messrs. Wills and Sons, distant from Nechells about a mile down stream. The total claims approximated £5600, and have all been settled for sums aggregating £2500 in cash, *plus* a quantity of breeze required at the Sewage-Farm works to replace material washed away or destroyed by the *débris* carried by the flood waters.

Coal and Oil and Tar Contracts at Birmingham.—It appears from the report to be submitted by the Gas Committee to the meeting of the Birmingham City Council to-day, that contracts have been entered into for the gas coal and oil required during the year ending June 30, 1902, at prices somewhat lower than those of the previous year. The Committee also report a considerable further falling off in the values of coke and breeze. In March last, the price of coke was 18s. per ton at the works. This was reduced in April to 15s. 6d. per ton; and the Committee, after very carefully reviewing the position, have made a further reduction in price to 12s. 6d. per ton, dating from the 2nd ult. They also report that they have arranged with the contractors the amount per ton to be paid to the Corporation for coal-gas tar during the year ending June 30, 1902, but at a price considerably below that of last year, "owing to the low market values of the bye-products of tar, upon which the contract price is determined."

MISCELLANEOUS NEWS.

DAMAGE TO GAS AND WATER PIPES AND MAINS BY LIGHT RAILWAYS.

A Board of Trade Inquiry.

An appeal of importance to gas, water, and light railway companies, was held at the Board of Trade last Friday week, on the question of damage caused by fusion or electrolytic action of light railway works, in the case of the Mitcham Light Railways Order. Mr. HOPWOOD, C.B., the Secretary of the Board of Trade (who was accompanied by Sir HERBERT JEKYLL and Mr. A. D. ERSKINE, the Assistant-Secretary of the Railway Commission) presided, and considered the objections to the confirmation of an Order granted by the Light Railway Commissioners for the Mitcham Light Railways.

Mr. VESEY KNOX appeared for the Croydon Rural District Council, who are the promoters of the Order; and Mr. MAY appeared for the Lambeth Water-Works Company, with Mr. H. WILKINS, the Secretary, and Mr. FRANCIS G. SHARROCK, the Assistant-Engineer.

Mr. MAY asked for two new clauses for the protection of the mains and pipes of the Company from electrolytic action of the light railway. He said the special provisions as to the use of electricity as motive power were not sufficient. The Model Clause was the outcome of the Joint Committee of 1893. But they had learnt a great deal since then; and opinion was pretty well divided among the experts as to what effect the escape of electricity had upon the pipes and mains of gas and water companies. The proposed light railways at Mitcham might not improbably be hereafter only an extension of the London County Council's system of tramways, which that body proposed to work by means of the conduit system of electric traction—in other words, with an insulated return current, which meant entire safety to mains. It was doubtful whether accidents, damages, and injuries resulting through this electric railway would cover damage to mains by fusion or electrolysis. What the Water Company wanted was to have it made clear that the damages, &c., included damages arising from the exercise of their statutory powers, and to make good damages to mains by electrolysis under all circumstances. Further, the Board of Trade should be empowered to amend their regulations from time to time, and make them retrospective in the sense that they should be made to apply to all future damage arising from schemes previously sanctioned; and that the Board should also be empowered at any time to require the insulation of return currents, if they deemed any such alterations desirable, notwithstanding that another system of traction might have been introduced and working at the time that the Board made such requirement. He submitted that the Board could not object to have fuller powers of control put upon it. If the powers were not needed, they would not be exercised; but it was necessary to have these powers to give compensation for future damage to gas and water companies. The new clauses he proposed were as follows:—

As to powers of Board of Trade in respect of use of mechanical power: The powers of the Board of Trade, under sections 50, 51, and 52 of this Order shall be deemed to include power subject to the provisions of those sections to make regulations requiring the Council to use such reasonable precautions, including insulated returns, as the Board of Trade might think necessary for the purposes of the said section 32, and the Board of Trade may, in like manner, from time to time, alter any such regulations.

For the protection of the Company of Proprietors of Lambeth Water-Works: For the protection of the Company of Proprietors of Lambeth Water-Works, the following provisions shall, unless otherwise agreed between the Council and the protected Company, have effect with respect to the use of electricity as a motive power on the Light Railway. The Council shall make full compensation to the protected Company for any loss or damage which they may sustain by reason of any fusing of, or electrolytic action on, their mains, pipes, or apparatus which may, in any way, be caused by the exercise of any of the powers by this Act conferred upon the Council.

The real protection against electrolysis was (said Counsel) by providing insulated returns.

Mr. HOPWOOD: The promoters have a right, you say, to elect whether they shall use insulated returns or uninsulated metallic returns of low resistance?

Mr. MAY: Yes. We ask that the Board of Trade shall have a right to prescribe one or the other at their option; and if, in time to come, the system they have prescribed is found to be a wrong one, they may then revert to the other system. At present, the Board have no such power. In the London United Tramways case, this question was discussed at great length; and after a good deal of expert evidence on both sides, the Committee refused to give what the Gas and Water Companies asked for—viz., insulated returns. Mr. Balfour Browne persuaded the Committee that the Board of Trade had full power at any time to alter the system originally authorized. He said the Board could alter their regulations, and could insist. If once they were satisfied that uninsulated returns were unsatisfactory, they could order the system to be converted to one with insulated returns.

Mr. HOPWOOD: Your view is that the Board cannot call upon the Company to alter the system; and, further, that the Board may or may not alter the regulations.

Mr. MAY: They may alter the regulations; but they cannot alter them in such a fundamental manner that they could alter the system. The statute gives the option to the promoters of the undertaking to adopt a system of insulated or uninsulated returns. On that material factor, the Board have no power to make any regulations. We agree that they may make and alter regulations in regard to the method in which insulated and uninsulated returns are to be used, and prescribing safeguards with regard to them; but they cannot say absolutely that uninsulated returns shall not be used.

Mr. HOPWOOD: How are you damnified if the regulation of the Board is effective, whichever system is used.

Mr. MAY: Our view is that it will be ultimately proved that uninsulated returns, if used with any sort of protective clause, will be quite inoperative.

Mr. HOPWOOD: That is, that no regulations made by the Board of Trade would be effective to prevent damage in the case of uninsulated returns?

Mr. MAY: That is it. Our scientific advisers tell us that sooner or later that state of affairs will arise; and this Company could go on doing damage *ad infinitum*. We say the Board should have power, if that state of things should arise, to prescribe insulated returns to the exclusion of uninsulated returns. If we should turn out to be wrong, and uninsulated returns are desirable, by all means let the Board of Trade prescribe uninsulated returns, if that is the ultimate safeguard to gas and water mains.

Mr. VESEY KNOX said that if insulated returns were put upon them, they would drop the Order, as they could not stand the cost.

Mr. MAY said it had been agreed between them that as this Order only referred to three miles of railways, neither side should be put to the expense of bringing expert witnesses, though recent experiments had proved that uninsulated returns must cause a lot of damage.

Mr. VESEY KNOX said he agreed with Mr. May that the Board of Trade had no power under the Model Clause inserted in the Order either to require insulated returns in the first instance if the promoters objected, or afterwards to make such an alteration in their rules as would require the promoters to use insulated returns where they had employed uninsulated returns of low resistance in the first instance. At the same time, subject to that restriction, he could not agree with Mr. May that there was no power to alter the regulations.

Mr. MAY: The regulations may be altered; but the system cannot be altered.

Mr. HOPWOOD: What do you say as to the prospective damage if the power is not given.

Mr. MAY: It is perfectly fair to say that there are conflicting views on the subject between the leading electrical experts of the country. On the London United Tramways Bill last session, Professors Ayrton, Dewar, and Perry expressed strongly the opinion that, with the present Board of Trade regulations, there was not only a substantial risk, but that damage would certainly be done sooner or later.

Mr. HOPWOOD: Yes; but did they go so far as to suggest to the Committee that the Joint Committee clause itself was ineffective?

Mr. MAY: Yes.

Mr. HOPWOOD: Did not their evidence go to this, that it might be necessary, in the interests of Gas and Water Companies, to strengthen the Board of Trade regulations?

Mr. MAY: I think not. Their view was that the Board of Trade regulations were insufficient, and, further, that, as far as they knew at present, there was no protection except by insulated returns.

Mr. HOPWOOD: Then they were in direct conflict with the report of the Joint Committee.

Mr. MAY: Exactly. I do not think that the Joint Committee went to that length. The position is this: There has been a very small experience, comparatively speaking, of these undertakings in this country working under the Board of Trade regulations. This is a new light since the Board of Trade held their inquiry, which has grown up with the development of the industry. We are gradually ascertaining facts which seven or eight years ago were absolutely unknown.

Mr. HOPWOOD: For the purposes of this discussion, I do not dissent at all from that position It is possible that, in the march of events, we may find it necessary to alter the Board of Trade regulations. But at the present moment, you are inviting me to alter the law as laid down in the Joint Committee clause.

Mr. MAY: Yes. We are not asking you to put upon this Company insulated returns now; but sooner or later we shall ask you to do that. The Board should keep it in their power to say that if damage is done by these regulations, then they should reserve to themselves full power to make fresh regulations, even though it went to the length of substituting insulated returns for uninsulated returns.

Mr. VESEY KNOX said there could be no doubt as to the power of the Board of Trade to alter any regulation which they made. There was no doubt that Mr. Balfour Browne, in the London United Tramways case, had incautiously over-stated the law of the case when he said that the Board could order insulated wires under their regulations. The Joint Committee clause did not give the Board power to require insulated returns if the promoters used uninsulated returns of low resistance. In this particular instance, they could not make the line with insulated returns. The line was a single one; and though it joined the London County Council with its conduit system, the promoters could not afford to go to that expense.

Mr. HOPWOOD: Do you contemplate a physical junction?

Mr. VESEY KNOX: Yes; with Croydon on one side, and the London County Council on the other. There is nothing to require the promoters to use insulated returns. It is a novel proposal, and I hope the Board of Trade will not assent to it.

Mr. HOPWOOD said the discussion had been useful; but no new matter had been advanced. Whatever lack of uniformity there might have been in parliamentary procedure as regarded Opposed Bills, the authorities of the House who dealt with Unopposed Bills had uniformly adhered to the Joint Committee clause. The Board of Trade had taken the same line. Mr. May had traversed the decisions of the Joint Committee and the opposed Committees on the one hand, and Mr. Vesey Knox on the other; but neither had referred to the decisions which had been given on this question by the Board of Trade. There had been absolute uniformity of practice by the Department. They had rejected amendments in substance of this description in the Wakefield case lately, and also in the cases of the Llanelly and the Middlesex County Council; and he felt that it would be impossible for him to advise the Board of Trade to accept either of the amendments. On the other hand, he desired to make it perfectly clear that he should give his adhesion to an alteration of the regulations, if and when it could be shown that they were ineffective for the purpose for which they had been framed.

Incandescent Gas Lighting at Elland.—At the last meeting of the Lighting Committee of the Elland District Council, it was decided to extend the incandescent system of public lighting in most of the wards of the town, with the view of giving better light than has hitherto been afforded in the more distant parts.

MUNICIPAL ADMINISTRATION AT HUDDERSFIELD.

Alleged Irregularities in the Gas Department.

Some weeks ago, attention was called, at a meeting of the Huddersfield Town Council, to certain proceedings on the part of corporate officials and members of the Council, which it was alleged amounted to unfair dealing. The matter was referred to a Special Committee, consisting of the Mayor (Alderman R. M. Shaw), Aldermen Hirst, Walker, and Sugden, and Messrs. Chatterton, Woolven, and Learoyd, for investigation, in accordance with the following resolution, passed on the 21st of August: "That a Special Committee be appointed for the purpose of investigating charges made against officials, of unfair dealings and actions, and generally into the conduct of members of this Council, or any other person, firm, or company who have been directly or indirectly interested in business matters with any department of the borough; and that the Committee have full power to inquire into matters, however remote, and to pay all expenses necessary to obtain evidence, and to report on each case with the least possible delay to the General Purposes Committee." The Committee held five sittings, the outcome of which was the presentation of the following report, signed by the Chairman (Alderman Hirst) and the members, at a meeting of the General Purposes Committee of the Council held last Tuesday:—

We had sittings for the purpose of hearing evidence on the following dates—viz., the 12th, 19th, and 26th of September, and the 3rd and 10th of October, 1901—and heard complaints of the Hygienic Stove Company, Limited, together with the observations of their Managing-Director and the statements of their witnesses. We also heard the replies and evidence of the persons concerned.

The appearances in the matter were as follows: Mr. J. H. Turner, Solicitor, for Alderman B. Stocks; Mr. Charles Mills, Solicitor, for Mr. Harman, Gas Engineer; Mr. J. Lewis Sykes, Solicitor, for Mr. Joe Sykes, Assistant Gas Engineer, and for Mr. Appleyard, Show-room Clerk; and Messrs. Buchanan and Shaw for the Hygienic Stove Company.

After due consideration, we find, with reference to the Chairman of the Gas Committee (Alderman Stocks) as follows: There was but one specific complaint made against the Chairman before the Committee—that he was interested as a shareholder in certain Companies (namely, Glover and Main, Limited, and the Richmond Stove Company), and that he was so interested was admitted by the Chairman. We find that the Chairman purchased his shares, paying the full value thereof in the ordinary course of business, and that he was entitled so to do under, and in pursuance of, the provisions of the Municipal Corporations Act, 1862. With reference to the letter, dated the 16th day of August, 1901, and written by the Managing-Director of the Hygienic Stove Company to the Chairman of the Gas Committee, a copy of which was subsequently sent to each member of the Council by the Company, we considered the statement contained in that letter, to the effect that the Main cooker was a "favourite" with the Chairman of the Gas Committee, and the suggestion that the possession of shares in Companies supplying other cookers had influenced his judgment against the cooker of the Hygienic Company, and find that there is no ground for suggesting that the Chairman of the Gas Committee abused or used his position as Chairman in any way to prejudice the interests of the Hygienic cooker or to advance the interests of other cookers; and, indeed, at an early stage of the first sitting the Managing-Director of the Company stated that his specific charges had nothing at all to do with the Chairman, and no evidence was produced in support of the suggestion contained in the Company's letter; but at the same time we considered it was unwise for the Chairman to hold shares in the Companies mentioned.

With regard to the Gas Engineer, Deputy-Engineer, and the Clerk (Mr. Appleyard), the specific charges made by the Company were "against the show-room officials, especially Mr. Sykes (Deputy-Manager) and Mr. Appleyard (Show-room Clerk), showing how the position they occupied had been taken advantage of to push the sale of certain cookers in preference to others." We find that the Gas Engineer held £300 in shares in Glover and Main, £200 of the same being held by him for his sister, that the Deputy-Manager held £100 in ordinary shares and £20 in preference shares in Glover and Main; and that Mr. Appleyard held £200 in ordinary shares and £100 in preference shares in Glover and Main (£50 of the preference shares being held by him for his mother), and 45 shares in the Richmond Company. We find that the officials concerned had purchased the shares at their full value in the ordinary course of business.

There was no specific complaint or allegation against the Manager of having pushed the sale of any cookers, and no evidence to that effect; and we find as a fact that his duties rarely called him to the show-room, and that there was no undue preference on his part in dealing with the gas-cookers.

With reference to the placing of the Main cooker upon the simple hire list, we find that this was brought about by the action of the Manager in putting before the Chairman, after the revision of prices of certain stoves, a document for signature without mentioning to the Committee or the Chairman the fact that such document purported to put the Main cooker on the simple hire list; and for this the Manager expressed great regret.

With reference to the Assistant Gas Engineer, we find that the charge made by the Company against him of having pushed certain Main cookers in preference to others not proved and not supported by the evidence.

With reference to the Show-room Clerk, we heard a number of witnesses, who supported the complaint of the Company, and we are bound, on the evidence, to come to the conclusion that he tried on various occasions to persuade intending purchasers of the Hygienic cooker to purchase some other cooker, and, in some instances, succeeded in so doing. We find that the Hygienic Company honestly and reasonably believed that they had a just grievance.

With reference to the conduct of affairs, we find indications of want of business methods. We recommend—(1) That the Manager, Deputy-Manager, and Show-room Clerk be directed forthwith to dispose of their shares in gas-cookers; (2) that it should be a general instruction to the officers and officials of the Council not to hold any share or interest in companies or concerns with which their departments have business relationships; and (3) we recommend that inquiries should be made with a view to considering whether the interests of the department would be better served by any alterations in the present system of purchasing and hiring gas-cookers.

At the ordinary monthly meeting of the Council on Wednesday, the General Purposes Committee recommended that the report be received and entered on the minutes; that the evidence be filed for the present; that the Town Clerk be instructed to send notices to the parties concerned, to the Hygienic Company, and to the Gas Committee, for their consideration; and that the report be printed and sent to each member of the Council. The Mayor moved the adoption of the recommendation. Alderman Hellawell seconded the motion, and called attention to the fact that the report had been allowed to appear in the Press before its presentation to the Council. Alderman Hirst said he had not the slightest idea as to how the report came to be published. Mr. J. F. Dyson rose to propose, in accordance with a notice he had given, that all future proceedings of the Committee should be public, and that representatives of the Press be invited to attend. Alderman Hirst said he was originally in favour of such a course, but afterwards saw that a serious injustice might be done to persons concerned if allegations made at one sitting went uncontradicted until the evidence in defence could be given at the next sitting a week later. A proposition in favour of Mr. Dyson being permitted to proceed with his motion was defeated by 19 votes to 15; but the discussion did not end there. Mr. E. A. Beaumont said that when the report was submitted to the General Purposes Committee, Alderman Hirst suggested that the evidence taken before the Special Committee should be destroyed. The policy of secrecy was likely to create suspicion. Alderman Hirst said questions were put in the Committee which had nothing whatever to do with the inquiry; and he had never had any intention of destroying the evidence. Mr. Dyson moved, as an amendment to the motion by the Mayor, that instead of the report being filed, the evidence be handed to the representatives of the Press for use as they might think fit. This was seconded by Mr. Quarmby, who said that, according to the finding of the Committee, the junior official of the Gas Department was practically made the scapegoat for the sins of the whole of the officials concerned. This was not warranted by the evidence, so far as he could see. It seemed to him that the Inquiry Committee were simply going to act as a whitewashing committee. The Mayor: No, not in the slightest. Mr. Broadbent spoke in high terms of the conduct of Alderman Hirst throughout the investigations. After further discussion, which at times became very heated, the amendment was rejected by a large majority, and the minutes of the General Purposes Committee were adopted.

THE GAS COOKING-STOVE QUESTION AT MORECAMBE.

The Allegations against the Chairman of the Gas Committee and Messrs. Richmond and Co.

It may be remembered that some weeks ago (see *ante*, p. 524) a heated discussion took place at a meeting of the Morecambe Urban District Council over the question of purchasing additional cooking-stoves with slot meters, as recommended by the Gas Committee. In the course of the debate, some disparaging remarks were made in regard to the character of the stoves, and reflections were cast upon the Chairman of the Committee (Mr. R. B. Abbott), who, it was suggested, had received some consideration from the makers, the Richmond Stove and Meter Company, Limited. At the monthly meeting of the Council on Monday last week, the Clerk read a letter, dated the 18th ult., from Messrs. Richmond and Co., respecting these statements, and asking for a public withdrawal of them. The first of the statements complained of was that "our stoves were spoken of as being only fit for the scrap heap;" and the second, "that Mr. Abbott was in receipt of some consideration in return for the business we are doing with the Council." This statement they contradicted most emphatically. Mr. Abbott, they said, had no interest in their business, and no commission would be paid to him or anyone in respect of the business done with the Council. Indeed, since the Town Council had begun to hire out the Richmond cookers, it had materially interfered with Mr. Abbott's trade for these stoves, because people preferred to hire instead of buying. The statement as to bribery (for it amounted to such) was likely to be more prejudicial than the one previously complained of. But both of them were bad; and Messrs. Richmond asked that the councillors making them should be requested to withdraw them. Otherwise the firm would, in self-defence, be compelled to institute proceedings.

The Chairman (Mr. J. Brown) said the letter was a copy of the one which had been sent to him, and which he was asked to read to the Council. He replied that he did not think he could take any steps in the matter, as the names of the speakers were given in the newspapers so that the firm could communicate with them if they wished to do so. He took this stand because he did not think it any part of his duty to ask members to withdraw statements, either for Messrs. Richmond or any other firm.

Mr. Plews said he supposed he was one of the members referred to in the letter. All he could say was that he did not think he had said anything wrong; and while he was a member of the Council, he should not be deterred by any threats from saying anything that was right and beneficial to the ratepayers.

Mr. Birkett, as the other member referred to, said he asked Mr. Abbott a very simple question, and expected to have a straightforward answer, and nothing more.

Mr. Abbott said he did not wish to argue the matter further. He thought the letter entirely cleared him from any imputations that had been made during the last three months as to his being in receipt of commission. That was a thing which, as he had said before, he hoped he would never have to prove. Mr. Birkett said this was a simple question; but he brought it forward first when he (Mr. Abbott) was appointed Chairman of the Gas Committee. It was answered in Committee, and he did not know why Mr. Birkett should have brought it up again in open meeting. "Evil be to him who evil thinks" would be a very apt quotation to apply in such a case. He received no commission on anything the Council purchased, whether it was in his own or any other business; and he would defy anyone to prove that he had ever done so. But if members of the Council had to go fending and proving, and the time of the Council was to be taken up with matters of this kind, it would not be for the best interests of the town. This matter had been magnified into a "gas scandal," and had been published far and wide in the papers as such. He did not say that Mr. Birkett intended it; but that had been the result, and it had been a very serious matter for him. He had received letters without end on the subject. The question had been put in all manner of ways, and it had done him serious injury in his business.

Mr. Gorton said when the Richmond stoves were selected by the

Committee, Mr. Abbott did not attempt, in any shape or form, to advise them one way or the other. The stoves were selected mainly because of the detachable fittings, which made them easy to repair if anything went wrong. He believed Mr. Abbott had acted in this matter in a thoroughly honourable way; and he was delighted Messrs. Richmond had taken the trouble to exonerate him from the charge of receiving commission. If he had thought for a moment that Mr. Abbott was susceptible to commission under such circumstances, he would not have sat on the Committee under him.

The matter then dropped.

PUBLIC LIGHTING OF LIVERPOOL.

The Electric Power and Lighting Committee of the Liverpool Corporation held their final meeting for the present municipal year last Friday, when Mr. C. R. Bellamy, the City Lighting Engineer, presented a report on the street lighting. He referred to the taking over by the Corporation in 1894 of the duty of lighting and maintaining the public lamps, and by reducing the illuminating power at midnight effecting a saving of £7000 per annum. In conjunction with this, the Gas Company were induced, following a reference to arbitration, to lower the price of gas for street lighting by 10 per cent., resulting in a further reduction of the lighting charge by £2500 per annum; making a total reduction of £9500. In 1898 it was decided to apply the system of incandescent gas lighting to the whole city; the extension to be carried out at a rate which the surplus funds at the disposal of the Committee would permit, which was estimated to occupy four years. The change, however, has been made in three years; leaving in the present year a surplus of £1000 applicable to other street lighting improvements. In the six years under review, the following work has been carried out in the city, at a first cost of £32,954; 353 new lamps have been fixed in the old streets; 928 passage lamps have been fixed, lighting the back entrances to 21,481 house; 152 arc lamps have been erected over an area of 3¾ miles of road; and 8908 incandescent gas-lamps have been fixed over 248 miles of road. The total number of lamps in use in the city amounts to 11,905, with an aggregate illuminating value of 2,261,500,000 candles, at an annual cost for lighting and maintenance of £36,187 11s. 8d.; the illuminating power being estimated thus: 10-ampere electric arc lamps, 500 candles; incandescent gas-lamps, 40 candles per burner; and ordinary flat-flame lamps, 16 candles. The year 1893 was the last in which the Gas Company had entire control; and the cost of the lighting for that year was £40,889 12s. 1d. The reduction of the charge for gas came into effect on Jan. 1, 1895, which brought the lighting and maintenance charges for that year down to £36,167. The illuminating power of the lamps has been increased before midnight from 465,750,000 candles to 1,576,500,000 candles, or nearly four times; after midnight, from 304,500,000 candles to 685,000,000 candles, or more than double; while the total charges have fallen from £40,889 in 1893 to £39,587 in the previous year, or a reduction of £1302. In 1895 the city boundaries were extended, adding 138 miles of road to the city, 128 miles of which were lighted by 2783 gas and six oil lamps, having an aggregate illuminating value of 137,500,000 candles, at an annual cost of £7194 12s. 8d. The following work has since been accomplished: The annual hours of lamplight have been increased from an average of 2907 to 3577; 15¾ additional miles of road have been lighted, involving the erection of 704 new lamps; and 132 miles of road have been lighted by means of 3359 incandescent gas-lamps, chiefly in lieu of ordinary lamps. The aggregate illuminating power of the lamps has been increased as follows: Before midnight, from 70 million to 397 million candles; after midnight, from 67 million to 225½ million candles. These figures indicate an increase in the lighting value of 5½ times to midnight, and three times from midnight to sunrise, which has been secured at an additional annual expenditure of £706, or 10 per cent. With an average total increase in the aggregate lighting of over 200 per cent., the public lighting throughout the old city (including passages) is costing less than in 1893. Deleting the expenditure on the first cost of installing the incandescent lighting, the actual reduction is £4702. Mr. Bellamy recommends a large additional extension of passage lighting.

As usual at the last meeting of the Committee, a vote of thanks was accorded to the Chairman (Mr. S. W. Higginbottom, M.P.) for his services. In acknowledging the compliment, he gave some particulars in regard to the electric lighting of the city. He said the output of electrical energy for the year ending Dec. 31 last was as follows: For lighting and power, 4,888,653 units; and for tramways, 6,675,682 units—total, 11,564,335 units. From the results obtained up to date, it was estimated that the output for the year 1901 would be as follows: For lighting and power, 6,250,000 units; and for tramways, 14,000,000 units—total, 20,250,000 units. The equivalent number of 16-candle lamps connected to the supply-mains on Dec. 31, 1900, was 149,495, which on the 1st of September this year had increased to 167,239. The prices charged for electrical energy were as follows: For lighting, 4d. per unit; for power, 2d. per unit for each unit up to 3000 units per quarter, and 1½d. per unit in excess of 3000 units per quarter, as against 7½d. for lighting and 5d. for power when the Corporation acquired the business in 1896. The Chairman went on to say that the report just presented by the City Lighting Engineer indicated the very successful way in which the street lighting of the city had been dealt with. During the past three years, incandescent gas-lighting had been applied to the whole of the streets of the city, and, though the lighting has been increased by more than 200 per cent., and a large additional number of lamps fixed, especially in passages lighting the back entrances to upwards of 20,000 houses, and the central portion of the city lighted by means of electric lamps, the actual cost had been reduced by £4700. The whole of this work had been carried out without touching the surplus resulting from the economies introduced by the Committee; and they had now funds available to confer greater benefits on the citizens in the direction which might be found most desirable—one that suggested itself being the extension of passage lighting.

A high compliment was passed on the work of Mr. Bellamy, and also on that of Mr. A. Bromley Holmes, the City Electrical Engineer.

PRESENTATION TO MR. ANDREW DOUGALL, OF HULL.

Last Wednesday some three hundred of the officers and workmen at the Hull station of the British Gaslight Company assembled in St. George's Hall, to show their esteem and respect for the late Engineer and Superintendent, Mr. Andrew Dougall, who, after 27 years in that capacity, has just retired.

Mr. DAVID BURNS, one of the foremen, and the oldest employee of the Company, occupied the chair. In opening the proceedings, he said it was something like 49 years since he entered the service of the Company. Many changes had taken place in that time, and the works had increased proportionately with the growth of the city, through the enterprise and sound judgment of their late respected chief.

At this point Mr. Dougall entered the hall, and was received by the employees standing—all joining in the Scotch refrain, "Should Auld Acquaintance be Forgot." When silence had been restored,

Mr. J. R. WARREN, Chief Inspector, at the call of the Chairman, proceeded to discharge the principal duty of the evening. Addressing Mr. Dougall, he said he had been requested to ask him to accept a service of silver plate—consisting of a tray, tea kettle, tea service, *entrée* dish, and case of spoons—together with an illuminated address, as a mark of the high esteem and respect in which he had been held during the time he had been Chief Engineer to the Company, and in recognition of the unvarying courtesy, kindness, and consideration shown to all who had come in contact with him. He had also to express the hope that Mr. Dougall would have a long life, and good health, to enjoy the rest which they thought he had so well earned.

Mr. DOUGALL, briefly, but none the less emphatically, expressed his thanks. Addressing those present as fellow officers and fellow workmen, he said it was not an easy thing for him to give expression to his feelings at the moment. He accepted the gifts they had been so kind as to present to him; and he would always reckon them among his most cherished possessions. He looked back upon his 27 years' connection with the Company with the greatest pleasure; and it was interesting to note the development of the gas-works during that period. When he first took charge, there was nothing beyond the battery of condensers but a big yard; and now the space was covered with all sorts of buildings, with the most modern appliances for gas manufacture. Then 27 years ago they were manufacturing 250 million cubic feet per annum, now they were manufacturing 1200 millions. Many other changes had taken place; and at this time there came to his remembrance the faces of a great number of old and faithful servants who had gone to their rest.

Mr. ANDREW DOUGALL, jun. (Tunbridge Wells), said it was not the first time that kindly feeling had been shown towards members of the Dougall family. On his own mantelpiece at Tunbridge Wells, there was the time-piece they presented to him on leaving the service of the British Gaslight Company, Hull, 22 years ago; and when he visited his brothers at Boston, Sevenoaks, and Margate, he found similar tokens of their regard. After what he had seen that evening, he felt convinced that the many acts of kindness shown to the sons were in a great measure prompted by respect for the father. He was sure his father felt that very much of the success which had been attained in the conduct of the works had been due to the goodwill and hearty co-operation of the officers and workmen. Now he was very pleased to see there that evening Mr. John Young, the new Engineer and Superintendent of the works. He was a gentleman who was held in high esteem in his profession, and looked upon as a leading Engineer and Manager. His genial manner and kindly disposition would no doubt make him an excellent chief, and one whom they could esteem and love. He believed that, during the next 27 years, the Company would make greater strides than in the past; and he hoped the change of management would be followed by increasing prosperity. He was sure nothing would cheer his father's heart more than to know that the Company were doing well and the men all happily employed.

Mr. JOHN DOUGALL (Boston) remarked that the magnificent presentation they had made that night was a splendid testimony to the respect in which they held his father.

Mr. JOHN YOUNG said he liked Mr. Dougall's start, when he said "fellow officers and fellow workmen." Now it was in that way he wanted them to think of him. Mr. Dougall had left him a very great gap to fill; and without their cordial co-operation he thought he would never be able to fill it. It was very gratifying to him that they had done him the honour to ask him to be present that night, to witness the sterling tribute they had paid to Mr. Dougall. When he looked round the magnificent gas-works that Mr. Dougall had left, he felt he had left behind him a monument that would redound to his honour and credit as long as a single brick stood. That part of his work would be easy. The difficult part would be to earn the same good feeling, the same kindly respect, as they entertained for their late Manager. If by following, in his own humble way, in the good road Mr. Dougall had trodden—if by trying to step in his footsteps—it could be done, he pledged his honour it should be done.

At the call of Mr. Young, the audience rose and gave three hearty cheers for Mr. and Mrs. Dougall and family. The rest of the evening was spent in song and harmony.

MORE STORAGE FOR HAMPTON COURT GAS-WORKS.

Inauguration of a New Gasholder.

The Directors of the above-named Company, together with the Officials and Contractors, assembled at the works, at Hampton Wick, last Wednesday, to inspect and inaugurate the new holder which has just been completed by Messrs. Samuel Cutler and Sons, of Millwall, from the designs and under the supervision of the Company's Engineer (Mr. W. E. Price, Assoc.M.Inst.C.E.).

The tank is 113 ft. 6 in. diameter and 33 feet deep. It is built of cement concrete 4 feet thick at the bottom and 2 feet thick at the ground level, and is backed with clay puddle 2 feet in thickness. A series of

iron bands 1½ in. by ¼ in. are inserted in the wall at a distance of 5 feet apart. The ballast and clay excavated from the site were both suitable for use in composing the concrete and puddle respectively. Altogether, 11,618 yards of earth were excavated; and the tank holds 1,600,000 gallons of water. In the construction of the tank 410 tons of cement were used; and the whole of the clay for the puddle was passed through a pug-mill. A dry well has been dispensed with; the inlet and outlet pipes, both 24 inches in diameter, being embedded in the clay backing. The contractors for the tank were Messrs. B. Cooke and Co., of Victoria Street, Westminster. The holder is at present composed of two lifts, respectively 107 feet and 109 ft. 3 in. diameter and 32 feet deep; but sufficient space has been left for a third lift 111 ft. 6 in. diameter, which will subsequently be added. It is composed entirely of steel, of which 170 tons were used. The guide-framing is on "Cutler's patent" principle; the chief feature being that the diagonal lattice girders are of equal dimensions and strength to the standards, a horizontal box lattice girder being fixed at the extreme top of the structure. In its construction, 120 tons of steel were used. The complete work (tank and holder) has cost £21 per 1000 cubic feet of gas storage capacity, which is very satisfactory, considering the high price of materials when the contracts were let.

Mr. Price gave a description of the construction of the tank and holder, and then asked the Deputy-Chairman of the Company (Mr. A. Goodman), who presided, owing to the ill-health of the Chairman (Mr. R. J. Kent), to open the valve controlling the gas passing into the holder. After a short speech by Mr. Goodman, congratulating the Company on the possession of so excellent a holder, and the Engineer and Contractors on the satisfactory manner in which the work had been carried out, the party took luncheon together on the works. During the subsequent proceedings, the Contractors presented the Chairman with a handsome *souvenir* of the occasion.

GEORGETOWN (BRITISH GUIANA) GAS COMPANY, LIMITED.

An Extraordinary General Meeting of the shareholders of this Company was held on Tuesday last at the Offices, No. 30, Gracechurch Street—Mr. CHARLES GANDON, the Chairman, presiding—to consider the following resolutions for the disposal of the works, and the consequent termination of the Company's career: (1) That, having regard to the result of the working of the Company during the last two half years, this meeting is of opinion that it is impossible for the Company to continue to carry on its business, and that the works be closed on the 31st of December next, or at such time as may be fixed by the duly empowered attorney of the Company in Georgetown. (2) That the power of attorney executed by the Company appointing George Russell Garnett, Esq., the local Director of the Company, to be the attorney of the Company in Georgetown, empowering him to take the necessary steps for closing the works, selling and disposing of the land, works, and moveable and unmoveable property of the Company, giving receipts and discharges to purchasers, and if absolutely necessary, to present a petition to the Supreme Court of British Guiana for legally winding up of the Company, be, and the same is, hereby approved. (3) That it is desirable, if the legal protection of a Court of Law be required for the interests of the Company and its debenture holders, that a petition praying for a compulsory liquidation be presented to the High Court of Justice in England under the provisions of the Companies Acts, 1862 to 1890.

The SECRETARY (Mr. Samuel Wood, F.C.A.) having read the notice convening the meeting,

The CHAIRMAN said that he would like to make a few remarks before putting the resolutions to the meeting. The results of the last two half-years' working (referred to in the first resolution) had been most discouraging. In fact, in the six months ending June 30, 1900, there was a loss of £200 on the operations of the Company; and in the half year to December last, a loss of £569 was experienced. The larger of these two losses was brought about by the increased cost of coal. There, however, appeared to be no prospect of the Company carrying on a profitable business; and as they were practically without funds, the Directors saw no alternative but to propose a resolution for the closing of the works and the disposal of the property. It might perhaps be asked why such a state of things had come about. In reply to this, he could only say that, in the first place, it was due greatly to the competition of the electric light. Another factor was the bad condition of the works—especially the mains, which, in order to carry on anything like a profitable business, would have to be entirely overhauled, at an expense, perhaps, of some £5000 or £6000. The Company had no money in hand for this purpose; and it did not seem in the least likely that they could induce the shareholders to subscribe such an amount. It was utterly impossible for them to continue operations with the plant in its present condition; and therefore the Directors thought it best that they should close down the business. It was proposed that this should be done on Dec. 31 next, because the present public lighting contract (there were, he might say, very few public gas-lamps) expired at that date. They could not cease working before then, or they might render themselves liable to penalties for breaking the contract. Although up to the present the Company had had a contract for the lighting of a small portion of the public lamps—the number, he thought, was 114—the authorities in Georgetown had now decided that the whole of such lighting should be given to the Electric Light Company; so that the last condition of the Gas Company in this respect would be worse than the first. Taking all the circumstances into consideration, the opinion of the Directors was that it would be best not to continue the business beyond the date of the expiration of the public lighting contract; and therefore they had called the present meeting in order that they might get the authority of the shareholders to close the works and dispose of the property of the Company.

The CHAIRMAN then separately proposed the three resolutions; and they were duly seconded (the first two by Mr. ALFRED LASS, F.C.A., and the third by Mr. H. W. ANDREWS) and carried.

IMPROVED LIGHTING FOR BRISTOL STREETS.

After many months—the offer referred to below having been made as far back as March last—there is, according to the "Bristol Times," every probability of the Bristol streets being ere long brilliantly illuminated. Some time ago, the Bristol Gas Company made an offer, in response to an invitation from the Sanitary Authority (who are, of course, responsible for where lamps are erected and the lighting thereof), which, if adopted, will result in giving the public over six times the present light, at a saving to the ratepayers of about £2500 per annum. The offer was the substitution of Welsbach 100-candle power burners in lieu of the 16-candle power burners at present in use in nearly 8000 lanterns. New lanterns, burners, mantles, &c., would, of course, have to be provided; and these the Gas Company would supply at their own cost—the only condition being that, in the event of discontinuance, the Sanitary Authority shall pay to the Company the sum of one guinea for such lanterns, &c., which would then become the property of the Sanitary Authority. At present, Apsley Road, City Road, Perry Road, and Redfield Road possess the new light; and already petitions have been received from various parts, asking that the roads near the petitioners' houses should be similarly treated. Up to the present, however, no decision has been arrived at. The Company will keep the lanterns, burners, &c., in order and renew mantles, paint the lamps, &c., at their own cost. As stated above, not only will the streets be much better lighted, but the material sum of £2500 a year will be saved. To-day everyone wants something better than he has at a less cost. The Bristol Sanitary Authority and the Gas Company are to be congratulated in rightly interpreting the spirit of the times.

PUBLIC LIGHTING OF HERTFORD.

Incandescent Gas and Electricity to be Employed.

It may be remembered that at the last quarterly meeting of the Hertford Town Council, the General Committee submitted a report from the Lighting Sub-Committee, in which the opinion was expressed that, under the existing circumstances, the streets could be "more efficiently and cheaply lighted with gas than with electricity." They therefore communicated with the Gas Company with the view of making some arrangement for the extension of the incandescent gas lighting system throughout the whole of the town. As the result, the Manager and Secretary of the Company (Mr. Robert Watson) submitted a scheme embodying the basis of an arrangement which was recommended for adoption. The principal portions of the scheme were given in the "JOURNAL" for Aug. 20 last (p. 464). After some discussion, the report was referred back to the General Committee for further consideration. At a special meeting of the Council on the 10th inst., the Committee again recommended the adoption of the report, with this addition—"that, in accordance with their offer, the North Metropolitan Electrical Power Distribution Company be asked to erect five arc lights in positions to be determined by the Lighting Sub-Committee, and an agreement be entered into with that Company to supply such lamps experimentally for six months at a cost not exceeding £25."

The MAYOR (Mr. A. Purkiss Ginn) moved—"That an arrangement on the basis of the terms contained in the report of the Lighting Sub-Committee, presented to the Council at the quarterly meeting held on the 8th of August last, he entered into with the Hertford Gas Company; that the Town Clerk be instructed to prepare the necessary agreement embodying these terms; and that the Mayor be authorized to seal the same on behalf of the Corporation."

Mr. USHER seconded the resolution.

Mr. SUMMERS-GILL moved, as an amendment—"That the General Committee be empowered to provide and fix suitable lanterns and No. 4 Kern incandescent burners complete to all existing street lamps not now so fitted; and that application be made to the Local Government Board for their consent to a loan to cover the cost." He reminded the Council that when this matter was before them on the previous occasion, a suggestion was made by a member that it might be inadvisable to borrow money from the Gas Company, as was proposed, wherewith to purchase the new lanterns and burners, or to allow the Company to maintain them. He (Mr. Summers-Gill) was strongly of opinion that they ought to keep the maintenance in the hands of the Corporation; and there was, he thought, very little doubt also that they should borrow the money and buy the lamps themselves. Of course, the Gas Company, in quoting for these lamps, had sent in net prices; and he could only assume that they included very little margin for profit. The Company were trading for profit, and the Corporation could not expect them to work for nothing. They were compelled by law to provide suitable burners to the street-lamps when they supplied the gas by meter; and if the Corporation bought the burners themselves, it might be that the Company would make some allowance. He mentioned this because it was important to the extent that a £10 note might be saved. By buying the lanterns, they would be acquiring lamps which could be used for electric lighting if they ever found it advisable to change their system. They might go a little farther, and engage an experienced fitter to look after the lamps, by which means he believed they would save over and over again the cost of keeping such a man, by the care he would use in fixing the mantles.

The MAYOR pointed out that this was done by the Company.

Mr. SUMMERS-GILL suggested that the Corporation should do it themselves, as he thought it would be very undesirable to hand over to the Company the management of the lamps.

Mr. BURTON seconded the amendment.

Mr. GRIPPER expressed the opinion that, with regard to maintenance, the system suggested by the amendment would entail more expense than if the work were done by the Gas Company.

The SURVEYOR (Mr. J. H. Jevons), in answer to a question put to him on the point, said he calculated that the maintenance under the terms offered by the Company would cost £60, whereas under the scheme proposed in the amendment it would come to £100.

Alderman SHELLY asked whether, assuming they wanted a skilled mechanic, during six or eight months of the year to look after the lamps, they supposed they would get one. He did not think the scheme proposed in the amendment would work satisfactorily. It was only a question of sentiment as to whether they should borrow the money of the Gas Company or get it through the Local Government Board; and he did not think sentiment counted for much in purely business transactions.

Mr. USHER agreed with Alderman Shelly that the proposer of the amendment had not shown any advantage that would accrue to the town by the adoption of what he had proposed—he had not proved that there would be any economy by his scheme.

The MAYOR pointed out that they would have to continue in darkness all the winter if they were going to wait until they obtained the Local Government Board's sanction for a loan.

The TOWN CLERK (Mr. T. J. Sworder) said it would take three or four months to get the necessary sanction.

Mr. BURTON: Pay it out of income, and the ratepayers will then get the benefit at once.

The amendment was carried by six votes to five, and the Highways Committee were empowered to make any alterations they might deem desirable in the present positions of the lamps, with a view to the better lighting of the streets.

The MAYOR further moved—"That the offer of the North Metropolitan Electrical Power Distribution Company to erect a series of five arc lamps, in positions to be determined by the Highways Committee, and to supply such lamps with energy for a period of six months, by way of experiment, at a total cost not exceeding £25, be accepted." He said he submitted the proposition with a great deal of pleasure as an experiment; and as a set-off against the expenditure of the £25, they would have a saving in the cost of gas-lamps for the period specified. He thought that while they had such an enterprising Company in their midst, it was only right that they should give them a trial for the future lighting of their streets.

Mr. MURCHISON seconded the motion.

Mr. ANDREWS said he was one of the deputation who went to Barnet to see the electric lighting, and he must confess that it was a great disappointment. The ordinary lamps were very poor, and would not compare with the gas-lamps at Hertford. He dissented from the resolution in Committee, because he considered that, under the scheme just adopted, they would have all they required for lighting the town; and that therefore it would be wasting £25 of the ratepayers' money to carry out the proposals before them.

Mr. CROUCH confirmed the statement as to the inferiority of the ordinary electric lighting at Barnet to the gas lighting at Hertford. At the same time, he considered that five arc lamps would be worth trying as an experiment.

Mr. BURTON pointed out that this matter had been thoroughly thrashed out by the Lighting Committee, who had come to the conclusion that the best method of lighting Hertford at the present time was by gas. The Council had no right to depart from this decision.

The motion was carried by eight votes to four,

GAS COMPANIES' COMBINATION AT SWINDON.

The shareholders of the Swindon New Gas Company and the Swindon Gas and Coke Company are shortly to be called together for the purpose of considering a scheme for the purchase by the former Company of the undertaking of the latter. The Directors of the two Companies have met together, and have come to an arrangement; the Directors of the old Company considering that the offer made to them by the new Company is such as they can recommend their shareholders to accept. Under the scheme, the new Company would use the works of the other Company for storage purposes only until their new holder is erected. The works of the old Company would then be abandoned. It is not expected that the shareholders of either Company will oppose the scheme, which it is considered will be in the interests both of the shareholders and the gas consuming public. The purchase will enable the new Company to extend their system to Wroughton and other suburbs of this rapidly increasing town that have been hitherto barred to them.

Beverley Gas Supply.—At the meeting of the Beverley Town Council yesterday week, the Gas Committee reported that, after appropriating £659 to interest on loans, £111 to depreciation on gas-cookers, and £685 in relief of the rates, there was a surplus of £732 on the working for the year ended March last. A proposal that the price of gas should be reduced from 2s. 11d. to 2s. 9d. per 1000 feet, was not seconded.

Extensions at the Halifax Gas-Works.—Last Tuesday, the Mayor of Halifax (Alderman W. Brear) started new machinery connected with works of extension carried out at the Corporation Gas-Works. They have involved an outlay of £150,000, and it is estimated that, with the increased plant, the possible output of gas will be raised from 4 million to 7½ million cubic feet. Included in the scheme is a tar-distillery. A tour of the works having been made by members of the Council, tea was partaken of. Alderman D. Woodhead, the Chairman of the Gas Committee, mentioned that in the Bill to be promoted next session power was to be sought to borrow a further sum of £150,000 for gas-works purposes, should the consumption afterwards seem to justify this expenditure. With coal decreased in price, and with the saving in labour which the new works would enable them to effect, the Committee anticipated a fine future for the gas undertaking. The profits for the past six years, including the sinking fund, had averaged £16,146 per annum, notwithstanding that the Committee had allowed a rebate of £8222 in meter-rents, that there had been a reduction in the price of gas to outside districts amounting to £1500, and that wages had been advanced £1500. The net capital of the gas-works now stood at £440,330; and he did not hesitate to say that, if offered to a private company, they would have no difficulty in obtaining £1,000,000 for the concern.

MR. BRAMWELL BOOTH ON RESTRICTING WORK.

In the "Editorial Note" this week on "Recent Developments of Labour Politics," reference is made to a letter recently addressed to "The Times" by Mr. Bramwell Booth, dealing with the communication by Professor Case, and the comments of our contemporary thereon. He explained that his object in writing was to point out one other consideration besides those referred to by the Professor—and he thought it was the gravest of all—for regarding the present opinions of large numbers of the working people as a danger to the nation, and that was the widely spread habit of restricting the amount of work which a man can, with reasonable industry, accomplish in the time for which he is paid by his employer, and its bearing upon the character of the workman himself. He then proceeded as follows.

I am well aware that such restriction has often disastrous effects upon business. I know also that, by increasing the cost—I use the word in its largest sense—of nearly all kinds of production, it tends to withhold work which would otherwise be undertaken, and thus defeats its own supposed object, by reducing instead of increasing the amount ultimately distributed in wages and the aggregate number of persons employed. Of this I have had only too effective proof in connection with business of one kind or another undertaken by the Salvation Army. In the conduct of our constantly increasing operations—I am not now referring to our social work for those who belong to the submerged classes—we are directly or indirectly in continual relations with many of the principal trades of the country, and I speak on this matter after considerable opportunities of observation. These facts are further emphasized by the contrast presented by some other countries in which the Salvation Army is also at work, and where it is also responsible for the expenditure of large sums of money and the employment, directly or indirectly, of large numbers of workpeople who are not in any way associated with its membership.

But this, serious as it may be, is but a commonplace of the subject. What I wish to point out is that this question is not only an economic and commercial, but a moral question. Whether or not the tacit understanding which so largely prevails, that no workman should attempt to do all he can for his employer in the time which he has agreed to sell to that employer, is in the end commercially profitable to that workman or to workmen as a whole, it is, I venture to think, a violation of the law under which moral beings are associated, and a perversion of the true social order; and from my own observation I am led to believe that it is only too often followed by the most unfortunate consequences to the manhood of the worker. It tends to dull his moral sense, to dwarf his idea of what is honourable, to commit him to a course of "eye service," which is really cunning and trickery, and, when it finds congenial soil in weak and truculent natures, ultimately reduces him to little more than a highly specialized cheat, intent upon appearing to give a full honest return for what his employer pays him while careful, above all things, to do nothing of the kind.

This is, I know, a hateful thing to have to say. It is a hateful thing to have to witness. I feel it all the more so because our people have such splendid qualities, and because the mischief comes largely of the modern theory that labour is in some way a discreditable thing—a pain and injustice—and that a man is, therefore, justified in doing as little as possible in the employer's time, while getting as much as possible for that time. And yet it is, after all, not so modern, for was not that, in principle, the same heresy which helped to bring in the ruin of the workers of Greece and Rome, and the downfall of those great communities? It is no doubt but another expression of the terrible Materialism of the day. I know no sadder or more lurid fact about this generation than its faith in wealth As though money could purchase the satisfactions without which human life is an inferno, and the earth a wild beasts' lair! What gold can buy a clear conscience, an enlightened mind, a healthy body, a loving heart? And when the British citizen is ready to sacrifice the first principle of honour, and, so far as his employer is concerned, to trample under foot the golden rule, and to do violence to all that is high and true in his own nature, for the sake of a supposed increase of a few pounds per annum in his earnings, one may well inquire: "What shall it profit a man if he shall gain the whole world and lose his own soul?"

May I venture to ask you to make an appeal to some of the Labour leaders to speak out on this question? No one who has any personal knowledge of such men as Mr. Burt, Mr. Hardie, Mr. Fenwick, Mr. Bell, and others I could name, can have the smallest doubt about their integrity and ability, or about their personal devotion to the highest moral standards. Will they not warn the people with whom they rightly have such enormous influence to make an end, for their own sakes, of this miserable contrivance for minimizing the good work a man can do in the world, and thus also warn them from a policy which, whatever its legal aspects or its supposed economic advantages, is little better than a moral suicide? Such an appeal can be made with all the greater force, so it seems to me, seeing that this evil is diametrically opposed to the first principle of true Unionism—the union of the strong on behalf of the weak.

SUNDAY LABOUR IN THE GLASGOW CORPORATION GAS-WORKS.

At the Meeting of the Glasgow Corporation last Thursday, the minutes of the Sub-Committee on Works of the Gas Committee, dated the 25th ult., set forth that at a meeting of the Special Sub-Committee as to extra pay for Sunday labour, there was taken into consideration the question of extra pay to the workmen at the various gas-works for such labour. After full deliberation and discussion, and having heard a report by Mr. Foulis on the subject, it was agreed to recommend that to all retort workmen employed on that day wages at the rate of time-and-a-quarter should be paid—Bailie Stevenson dissenting.

Mr. R. M. MITCHELL moved the approval of the minutes.

Bailie STEVENSON moved, as an amendment, that the paragraph

with regard to Sunday labour be sent back for further consideration. What was proposed was, he said, entirely contrary to the policy which had been enforced in the Corporation for the last five or six years, which was that there should be no unnecessary Sunday labour—that employees of the Corporation should not be required to work more than six days a week, but that when Sunday labour was indispensable it should count in the six days, the men getting corresponding time off on other days. It was proposed to pay these men time-and-a-quarter for extra work. It was well known that the pay for extra work had resulted in men preferring Sunday labour. In the Tramways Committee, the resolution was that only six days' work should be allowed, and that a man who had to work on Sunday should get a corresponding day during the week. It would be remembered that there was actually a deputation of men from one of the depôts asking that they should be allowed to work on Sunday in a seven-day week. There were in all trades a certain number of greedy men who would act thus, and seek to deprive a corresponding number of their fellows of their fair share of work; but they should get no encouragement from the Corporation.

Bailie FERGUSON seconded the amendment.

Mr. CARVICK-WEBSTER said the Committee had not rushed this matter. They had taken into consideration everything that had been stated, and had found it was not possible to do without this work. He might take it that they were all agreed that Sunday labour should, if possible, be avoided, or, if it was impracticable, that it should be reduced to a minimum. In the gas-works this was the course followed. To enable members to understand the question, he explained that the work was done by shifts, each shift working eight hours, and the only way to avoid disorganization would be to employ an extra shift. These men would require training; they could not take men off the street and set them to do the work. The men worked best in gangs, and even the temporary absence of one man caused inconvenience. The cost of an extra shift would be about £30,000 a year; but by the proposal of the Committee the extra cost would be about £1250. It was the universal practice throughout the kingdom that extra pay should be allowed in gas-works for Sunday labour. He also reminded the members that a promise was given some time ago to consider the question of wages; but dear coal and other matters had prevented this from being done. Further, there were men in the gas-works who did get extra pay for Sunday work; and it was a grievance of the men who worked alongside of them that they were in a different position.

Bailie WILLOCK said that two meetings had been held, and Bailie Stevenson's views were fully considered. All the men employed in the gas-works on Sunday were paid overtime at the rate of time-and-a-half except the retort-men; and he considered the recommendation of the Committee ought to be agreed to.

Mr. SHAW said that when the men had to work on Sunday they should be paid for it; and the recommendation of the Sub-Committee to allow them time-and-a-quarter was a small concession.

Mr. MITCHELL, in reply, said he could assure the Council that the Gas Committee were anxious to do justice to all their workers. It was thought the retort-men had been rather unfairly treated; for, while other men received time-and-a-half for overtime, these men worked on Sunday without any extra allowance. The Committee did not want their men to work on Sundays; but the citizens wanted gas on the Monday, and therefore they had to keep the retorts going on Sunday. He hoped the Council would allow the Committee to manage their own affairs, and he could assure them they would not always be guided by the opinion of any one member of the Committee—Bailie Stevenson or anybody else.

A show of hands was taken, when the minutes were approved by a large majority—only four voting for the amendment.

GAS-WORKS EXTENSIONS AT JOHNSTONE.

On Tuesday last, the Corporation of Johnstone formally opened a large scheme of extensions at the burgh gas-works, which have just been completed according to plans, and under the superintendence of, Mr. James M'Gilchrist, of Dumbarton. These consist of a new retort-house, at the end of the existing one, containing a bench of six ovens, back to back, with eight retorts in each—48 in all—fired by regenerative furnaces erected according to the patent of Mr. G. R. Hislop, of Paisley, and having applied to the hydraulic main Hislop's patent tar-extractor; a new set of annular condensers, containing eight columns, supplied by Messrs. W. C. Holmes and Co., of Huddersfield; a new mechanical scrubber, also by Messrs. Holmes; two new exhausters, steam driven, by Messrs. R. & J. Dempster, of Manchester; a new coal-store to hold 1000 tons of coal, with railway siding into it; a range of offices and show-room; a new chimney to the retort-house; and a workmen's room, fitted with dining and lavatory appliances. This is practically a renewal of the works; the only old plant left being the purifiers, four in number, 12 ft. by 16 ft., erected by Messrs. Hanna, Donald, and Wilson, of Paisley, and the gasholders, three in number, of which the latest built, and largest, is of 240,000 cubic feet capacity. The old retort-bench, a single stack containing 32 retorts, in fours, has been allowed to stand, with the exception of one oven, which has been removed to make room for a steam-boiler which is being put in. The new plant is capable of dealing with about double the quantity of gas the old plant put through.

Provost LANG, addressing the members of the Town Council and a few invited guests, in the retort-house, said he understood that the gas-works were originally erected by the Johnstone Millowners, about 1824. At that time, there were 18 or 20 cotton mills on the River Cart; and it was necessary that they should be well lighted. Hence the erection of the first of these gas-works. In 1879, Johnstone was made a burgh; and the then Town Council thought it would be judicious to take over the gas-works. They arranged to do so at a valuation. The price paid was £23,000. The price of gas at the time of the transfer was 5s. 5d. per 1000 cubic feet; it was now 3s. 1½d. The quantity of gas then made was 18½ million cubic feet a year; last year it was 45 million cubic feet. During the first ten years, the increase in the output was 16 per cent.; during the last ten years, it had been 120 per cent. The increase last year over the preceding year, was more than 3½ million cubic feet, and was greater than the increase during the first ten years. The total cost of the extensions would be about £10,000.

Mr. M'GILCHRIST said it was not so long since the old retort-house was built; but the new one was a great improvement upon it. There was plenty of space, light, and ventilation in it, which should enable the men to lead healthier lives. He had no doubt the retort-house would save as much money as would meet the big expenditure.

Provost Lang then partly charged one retort, which was held to be the opening ceremony.

Ex-Provost ARMOUR, the Convener of the Gas Committee, proposed a vote of thanks to Provost Lang, which having been accorded, the company walked round the works—Mr. M'Gilchrist acting as guide.

The company afterwards dined together in the Municipal Buildings, with Provost Lang in the chair, and Ex-Provost Armour and Bailie Daly as croupiers.

Mr. G. R. HISLOP, in proposing "The Gas-Works," said he felt constrained to say that the works reflected the highest credit upon the gentlemen who managed the affairs of Johnstone. The improvements they had seen spoke to the fact that the Commissioners had not been deterred, like some others, from carrying out these extensions and improvements at the present time because of the boom of electric lighting; and they had been wise to do so. It was well to remember that gas had made a position for itself which no other form of lighting could at all approach. There was such a wide gap between electricity and gas, that electricians could have little hope of ever reaching the same position. Therefore gas engineers ought to be in the most happy state.

Ex-Provost ARMOUR, in acknowledging the toast, said that, down to 1898, the Commissioners expended £23,000 upon extensions at the gas-works; but of that amount they had repaid £13,971, which made a difference in their favour of £2000 a year. The gas-works were the biggest asset the Corporation had.

Ex-Provost THOMSON proposed "The Engineer."

Mr. M'GILCHRIST, in acknowledgment, said his first connection with Johnstone was at the transfer in 1879. When he came there to look over the old works, he could assure them that he did so with a feeling of dismay. All the same, he came to a good place when he came to Johnstone. He believed that the success which had been attained in Johnstone had induced many corporations to take over the gas-works; and he did not know of any corporation who had done so who ever regretted the step.

Mr. M'Gilchrist, in the name of the Contractors and the Engineer, presented ex-Provost Armour with a very handsome brass standard oil-lamp with square onyx table, which he duly acknowledged.

SALES OF SHARES AND STOCK.

At the Mart, Tokenhouse Yard, E.C., on Monday last week, Mr. Alfred Richards sold, by instructions of the Directors of the respective Companies, stocks and shares in the Ilford and Pinner Gas Companies, the Lowestoft Water and Gas Company, and the Southend Water Company. The first-named Company offered a new issue of £10,000 of 4 per cent. perpetual debenture stock, in £100 and £50 lots. The former fetched from £100 12s. 6d. to £101 5s. each, while the latter were sold for £50 7s. 6d. and £50 10s. apiece. The Pinner Company's new issue consisted of 400 ordinary £5 shares (last dividend 7 per cent.), which were purchased for £6 5s. and £6 10s. each. The 500 additional ordinary £10 shares, ranking for a maximum dividend of 7 per cent., but carrying at present 5¾ per cent., which were offered by the Lowestoft Water and Gas Company, realized prices ranging from £12 12s. 6d. to £13 apiece; while £1000 of 4 per cent. perpetual debenture stock of the Company was sold at prices ranging from £114 to £116 per cent. The Southend Water Company offered 1000 new ordinary £10 shares, carrying 5 per cent. dividend, which were bought at £11 17s. 6d. and £12 apiece. The next day, Messrs. Fox and Bousfield sold at the Mart, by order of the Directors, a new issue of £20,000 of ordinary capital of the Woking Water and Gas Company, in £10 shares, which fetched from £10 to £10 10s. each; and some original £10 shares in the North Middlesex Gas Company at £21 10s. apiece. At the offices of the Newcastle and Gateshead Gas Company on the same day, Mr. Mack offered for sale, in accordance with instructions received from the Directors, £40,000 of ordinary stock of the Company. It ranks for a standard dividend of 7 per cent., subject to the sliding-scale, under which, while the price charged for gas remains at 2s. 2d., the authorized rate of dividend payable on the ordinary stock will be £8 15s. per cent. per annum until the 31st of December next, and after that date at the rate of £4 7s. 6d. per cent. upon the converted stock. Biddings failed to reach the reserve price in respect of a portion of the stock; but what was sold fetched, on an average, rather more than £215 per cent. After the auction, nearly the whole of the remainder of the stock was disposed of. On the same day, Messrs. Fenn and Co. sold some "A" shares in the Colchester Gas Company, at prices ranging from £45 15s. to £47 10s. each; and some "B" shares at from £31 to £32 10s. apiece. Messrs. Tootell and Sons recently sold at Maidstone four lots of £50 shares in the Maidstone Gas Company at £98 15s. per lot; while £21 of 3 per cent. debenture stock of the Company fetched £18 10s. Five lots of £100 of ordinary consolidated stock of the Company were sold for £200 each; five similar lots realizing 10s. more apiece. Two £50 lots changed hands for £100 5s., and 13 similar lots fetched 5s. less. Ten lots of £25 of stock in the same Company fetched from £49 10s. to £50. On the same occasion, Messrs. Tootell and Sons sold five £5 shares in the Sutton Valence Gas Company for £4 5s. each. An annuity of £5 12s. of the Arbroath Gas Corporation was lately sold by auction at the upset price of £176, which is equal to 31½ years' purchase.

At the present time the metric system is compulsory in twenty countries, representing more than 300 million inhabitants—viz., Germany, Austria-Hungary, Belgium, Spain, France, Greece, Italy, the Netherlands, Portugal, Roumania, Servia, Norway, Sweden, Switzerland, the Argentine Republic, Brazil, Chile, Mexico, Peru, and Venezuela.

ELECTRICITY SUPPLY AT PLYMOUTH.

A Financial Failure.

Now that the electric lighting undertaking at Plymouth has been proved to be a financial failure, steps are to be taken to rehabilitate it by a resort to the expedient, familiar to those acquainted with municipal book-keeping methods, of readjusting the charges between the Electricity Department and the other Committees of the Corporation. Far and away the best customer which the electricity undertaking has is the tramways. Out of a total of 860,000 units expected to be sold during the present financial year, the tramways will take 528,000 units; while of the remainder, 110,000 units, or one-third, will be used for the public arc lighting. Although the total output this year will be double that of last year, the financial result will, it is anticipated, be a further addition of £2247 to the deficiency of £3152 on the undertaking at March last. This increasing deficit on a new and rapidly extending business, has given pause to some of the advocates of municipalization, who have been running riot for the past ten years. The Electricity Committee propose to hide the ugly fact by increasing the charges for the public services. This will have the effect of adding £350 to the greatly increased charge which the ratepayers have been paying the last year or two for public lighting. It will also take a considerable proportion of the profit which the Tramways Committee have been hoping to realize towards the reduction of their heavy adverse balance of former years. According to an account prepared by the Borough Treasurer, the cost of the electric current supplied to the tramways last year was 3·77d. per unit, while the charge was 3·50d. per unit. Private consumers who paid 4·50d. per unit were not supplied for less than 6·20d.; while the arc lighting, for which 1·70d. was charged, cost 2·73d. For the present year, the relative cost of production is estimated at 2·66d. for the tramways, 5·70d. for private lighting, and 2·45d. for arc lighting; while the receipts will be equivalent to 2·3d. from the tramways, 4·5d. from private consumers, and 1·68d. from the public lighting. In order to "adjust accounts," the Electricity Committee decided that the Tramways Committee and the public lighting departments should be charged for current at cost price.

This proposal gave rise to considerable discussion in the Town Council yesterday week. Alderman Radford, the Chairman of the Electricity Committee, justified the increase on the ground that each Department should bear its own proper charges. It was true it might be said that the present charge for the supply of the tramways was a bargain between the two Committees; but the fact was that the price of 2·3d. per unit was suggested by the Electrical Engineer in 1897, when it was assumed that with this charge the works would be on a paying basis. His own feeling, added Mr. Radford, was that they ought to charge a fixed price for the current, and that the price should be not less than the average actual cost, which came to 3·41d. If they charged only 2·66d. per unit, which was the cost without any allowance for depreciation, the tramways would still benefit at the expense of the electricity undertaking. Mr. J. C. Brown at once gave point to the remarks of the Chairman of the Electricity Committee by moving, as an amendment to the recommendation of the Committee, that the price charged for current for the tramways be 3d. per unit. He contended that it would be more advantageous to have a fixed charge than to wait until the end of the year, and then find differences of opinion as to what was the cost price. It was very undesirable that the electricity account should show a deficit at the end of the year; for if there was a deficit it would be put on the rates. Mr. Page, the Chairman of the Tramways Committee, strongly opposed the amendment, which he seemed to suggest was designed to hide the incapacity and mismanagement of the Electricity Department. The amendment was, however, carried by 24 votes to 21. The discussion was continued on another amendment, to the effect that the price charged should be 2·3d. per unit. This enabled Mr. Page to further criticize the management of the electricity undertaking. He pointed out that in Bolton, Dundee, and Southampton the charge for current for the tramways ranged from 1½d. to 2d. per unit, and the undertakings yielded a profit; while in Plymouth, with much higher charges, there was a loss. The tramways, he contended, were the salvation of the electricity works; but they ought not to be made to pay part of the cost of electric lighting. There were 200 private electric light users, who were subsidized to the extent of a halfpenny rate, because they were charged less than cost. Other members of the Tramways Committee strongly supported the protest against an increase of the charge; and it was also contended, with some force, that the price should not be fixed by the Council, but by an expert. The amendment that the charge should be 2·3d. was, however, rejected. The price of the current supplied to the tramways will therefore be 3d., while that supplied for the arc lighting will be at its cost, now estimated at 2·45d. Private consumers will still be charged 4½d., at a loss to the Corporation of about £1100 in the year. The fact that the public lighting is under the control of the Electricity Committee may explain why no protest was raised against increasing the cost of current for the arc lamps.

ELECTRIC LIGHTING NOTES.

At a meeting of the Cardiff Electric Lighting Committee last Tuesday, the Electrical Engineer (Mr. Ellis) reported that the income for the half year ending Sept. 30, 1900, was £3583, whereas for the six months this year it was £4787—showing an increase of £1204. The estimated increase for the twelve months ending March, 1902, was only £1670; and this amount has therefore been almost reached during the first six months, which included the summer season.

The Electricity Committee of the Manchester City Council last Thursday decided to accept the tender of Messrs. W. T. Glover and Co. for the supply, delivery, and laying of a number of mains. The amount of cable to be supplied under the contract is 147 miles—to be used for lighting and tramway traction purposes. It is stipulated that the cable must be laid within six months of the order being given. The amount of the contract is a little over £130,000. Messrs. Glover's tender was not absolutely the lowest; but the Committee had regard to the question of delivery.

From the annual report of the Tunbridge Wells Borough Electrical Engineer, it appears that last year the work for the first time showed a loss of £482. This is attributed to the advance in the price of coal, from 20s. 9d. to 36s. 6d. per ton, representing an increase of £1380. The loss will not fall on the rates, as there is a reserve fund of £2039, after paying £2750 towards the reduction of the rates in past years. The average price charged private consumers is a fraction over 4d. per unit; and since the works started in 1896, the number of electric lamps in the borough has increased from 7486 to 35,200. The income from sales of current last year was £9110.

Killarney does not receive its electric light on the continuous current system—indeed, it is so intermittent that Mr. Jeremiah J. O'Connor complained at the Quarter Sessions to his Honour Judge Shaw, before whom he was hailed for non-payment of his account by the Electric Light Company, that the light had been cut off for six weeks. The Company had allowed Mr. O'Connor a deduction from the amount payable under his contract, equivalent to the length of time during which the light failed; but apparently they rated their commodity at so low a value, that they declined to admit that he had suffered any damage through being deprived of that with which they had agreed to supply him. His Honour, however, refused to allow this modest view to prevail, and gave a decree for the deduction of a further £2 10s. from the amount of the account, without prejudice to any claim O'Connor might have against the Company. In giving judgment, his Honour remarked that by such failures great inconvenience was caused to persons depending on the light who had not made any arrangements to meet emergencies of this character. We imagine that in future there will be but few electric light consumers found in Killarney so lacking in foresight as not to keep another string to their bows.

An esteemed correspondent has called our attention to an act of coercion on the part of the District Council of St. Anne's-on-the-Sea which certainly calls for some explanation. According to the story told in the "Blackpool Times" of the 16th inst., a resolution was passed at the meeting of the Council the preceding week that the request of a local builder—a Mr. Sutcliffe—for a cable to be laid in a road in which he was building some houses should only be granted on the condition that he would give "a written undertaking to wire the whole of the houses, and not put any gas-fittings therein." A letter containing this resolution was duly sent to Mr. Sutcliffe; and the circumstance called forth the following comments from the above-named paper: "Why members of the Council should allow the resolution to be confirmed unchallenged, and then deprecate the action of the Electric Lighting Committee, is more than mortal man can understand. Mr. Sutcliffe has decided not to depreciate his property by being lured into the electric web. Surely the Committee have sufficient confidence in their superior light, and enough business acumen, to conduct their transactions on broader lines! What would they have to say if the Gas Company retaliated, and refused to give a supply of gas for cooking-stoves to dwellings using electric current for lighting purposes? But, as a matter of fact, neither the Gas Company nor the Electric Lighting Committee have the power to deny Mr. Sutcliffe or any other builder a supply of gas or current. The Orders of both prescribe pretty clearly what powers they possess in this direction. If Mr. Sutcliffe thinks he can increase the value of his property by making provision for both methods of lighting, it is nothing to nobody. He has his houses to let or sell. It is not the ratepayers' wish that there should be a policy of coercion. The works can he run—and, in time, run successfully—without these unbusiness-like methods of compulsory consumption. Builders are not the only persons who suffer from such a proceeding. Ironmongers and plumbers, who deal in gas-fittings, have something to say. The ratepayers as a body, who are shareholders, so to speak, in the electric lighting works, desire to see the undertaking successful; but they decry such unfair tactics as those sought to be employed. Whether there be profit or loss on the first year's working—and no intelligent ratepayer who knows anything at all of these undertakings in other towns expects profit so soon—we want dignified management by our representatives. It is hoped that the Council will see the error of their way, and get the coercive resolution rescinded without delay. Let us build up our only municipal trading concern on sound business principles."

A problem of some difficulty has been set for the solution of the Exeter City Council. When they acquired the electric light undertaking a few years ago, it was with the knowledge that the time was not far distant when the works would have to be removed to another site. The site has been found, and the Council have now to decide between rival schemes for the erection of the works. Mr. Robert Hammond, who had previously advised the Council in connection with the purchase, was called in as Consulting Engineer; and some 140 alternative schemes and tenders were submitted to his consideration. Acting on his advice, the Electric Light Committee came to the conclusion that the contract for the entire equipment of the station should be placed in the hands of one firm, and that the two-phase system should be adopted. Following upon this, they recommended the Council to accept the tender of the British Westinghouse Company for the sum of £28,989. Mr. Hammond, in a detailed analysis of the tenders, spoke very highly of this firm, and also made a favourable reference to the steam-turbines of Messrs. C. A. Parsons and Co., as costing less in repairs and working with less vibration than ordinary slow-speed reciprocating engines. Mr. Hammond also recommended the Committee to consider seriously whether or not it is advisable to substitute low-pressure generation and feeding for the present high-pressure transformer system. Upon this point he did not express any definite opinion, but reminded the Committee that this was the last chance of making the change, if change were desirable. The matter came before the City Council yesterday week, and led to a protracted discussion. It transpired that Mr. Hammond did not agree with the manner in which the tenders had been invited, and was in favour of a division of them into separate contracts. The Committee, however, came to the conclusion that it would save the appointment of a Consulting Engineer, at a considerable cost, if the whole scheme were entrusted to some responsible firm who would hand over the works in going order. Mr. Hammond had, on the other hand, calculated that by taking separate tenders, the work

would be done for £27,981; so that there does not seem to be so much as the Committee imagine in their reason for accepting one tender for the whole plant. They were influenced in adopting the two-phase system by the consideration that it would enable them to utilize the greater part of the present mains and transformers. With regard to the suggestion that the turbines should be adopted, the Committee came to the conclusion that these appliances were in an experimental stage; and as the questions of space and the absence of vibration were not of material importance on the site of the new works, it was not desirable to go in for experiments. As an amendment to the Committee's recommendation, it was proposed that the contract should be placed with Messrs. Parsons and Co. for the sum of £27,981, the Sub-Contractors to be Messrs. Babcock and Wilcox for the boilers, and Messrs. Ferranti and Co. for the machinery other than the engines, which would, of course, be on the turbine principle. The Council debated the relative merits of turbines and reciprocating engines for upwards of three hours, and then adjourned for a fortnight.

RATING OF THE GRAND JUNCTION WATER-WORKS.

Valuation Appeal.

At the Surveyors' Institution last Tuesday, Mr. ERNEST PAGE, K.C., opened the inquiry into the value of the Grand Junction Water Company's undertaking, which had been ordered by the Clerkenwell Sessions. In June of the present year, the Company appealed against their rating assessment in the parishes of St. James', Westminster, Marylebone, Paddington, St. Margaret and St. John, Westminster, and St. George's, Hanover Square, to the Assessment Committee, by whom the matter was referred to Mr. Page to make a valuation of the hereditaments with respect to which the appeal was made.

Mr. BALFOUR BROWNE, K.C., Mr. BOYLE, K.C., and Mr. SNAGGE appeared on behalf of the Company; Mr. MARSHALL, K.C., and Mr. DIGHTON POLLOCK for St. James', Westminster; Mr. ENGLISH HARRISON, K.C., and Mr. RUSSELL GRIFFITHS for Marylebone; Mr. DANCKWERTS, K.C., and Mr. CUNNINGHAM GLENN for Paddington; Mr. DANCKWERTS and Mr. RYDE for St. George's, Hanover Square; Mr. RYDE for St. Margaret and St. John, Westminster.

Mr. BALFOUR BROWNE, in stating the case, said that the matter, except in one or two particulars, was quite on the ordinary lines. In the parishes against which the appeal was made, there were no important works—such as reservoirs, pumping-stations, or things of that sort; but, what was more important to the parishes, there were a very large number of service-pipes, or directly contributing portions of the undertaking. First, they had to arrive at what the directly contributing portion of the undertaking was worth on the ordinary Parochial Assessment Act principles; and that was done by arriving at the receipts, by deducting the expenses incurred in earning them, then by relegating to the tenant a certain percentage upon the capital involved, and by deducting a sum necessary to maintain the heriditament in a position to command the rent. In this way, the assessable value of the entire undertaking was arrived at. The figures were very large; but only five parishes were involved in the inquiry, although, of course, the Grand Junction Water-Works undertaking ramified to a far larger number. Having arrived at the rateable value of the directly contributing parts of the undertaking, they had then to put back into the parish what had been taken out in the first instance—viz., the indirectly contributing parts. There were a large number of mains, which had been taken out to arrive at the value of the directly contributing parts. In this particular case, when Mr. William Marshall, the Company's principal witness, was before the Assessment Committee, he used the last available figures at that particular time—viz., those ending the 30th of September, 1899. But since then another half-year's figures were available; and the figures now to be placed before Mr. Page were for the year ending March 31, 1900, which brought out the rateable value, *plus* rates, in those parishes at £20,353. That worked out at 9·35 per cent. of the total water-rental earned in the year. If that could be made out, it became a perfectly easy matter to relegate to each of the five parishes the proportionate part of the £20,353 by applying that figure (9·35) to the water-rental earned in the particular parish. That would represent the rateable value *plus* rates of the directly contributing part in the particular parish. Besides that, they had to put back the indirectly contributing part; and these two together would represent the value in the parish of the whole undertaking of the Company. The gross receipts were £219,155; and in that particular year there was a sum of money included in the gross receipts, which was not paid in the ordinary course of business by people having water supplied to their houses, but was paid because the Grand Junction Water Company supplied a certain amount of water to the East London Water Company, for which they were paid.

The ARBITRATOR: They were bound to supply that, were they not?

Mr. BALFOUR BROWNE said they were not bound to do so, but there was a famine in East London, and the other Companies came to their assistance. From the sum of £219,155, they had to deduct the total working expenses, less rates, which in that year amounted to £81,315. This figure included the item of extra cost to the Company, which would not always recur, caused by the repairs rendered necessary by the extremely severe frost in 1895. That cost the Company had thought it right to repay in five years.

The ARBITRATOR asked how it was treated in the accounts.

Mr. BALFOUR BROWNE said that the expenditure had been submitted to the Government Auditor in the usual way, who held that a certain portion ought to be paid out of capital, and another part out of revenue. They had only treated as a working expense in that particular year one-fifth of the amount which the Government Auditor said ought to go to revenue. At the last quinquennial valuation, the Company were put to very considerable expense by a rating appeal; and the costs had been spread over five years. One-fifth of the total amount also appeared in the £81,315. Deducting this sum from £219,000, it would be found that the net receipts divisible between landlord and tenant, *plus* rates, amounted to £137,840. The next item was the tenant's share, which generally gave rise to considerable difference of opinion. In the present instance, however, the Arbitrator would not probably be troubled by the question, as it was practically agreed that 17½ per cent. should be allowed to the tenant. But before coming to the 17½ per cent., the point would arise as to how much a tenant would require; and that was open to very great difference of opinion. The Company considered that a tenant would require 7½ months of the total working expenses, amounting to £51,021—five-eights of the £81,315. Mr. William Marshall, their principal witness, had eliminated from the accounts all matters which might be called landlord's capital—certain things which the landlord would have to provide—and had arrived at the figure of £51,021. The revenue came in exceedingly slowly. If a tenant entered on the 1st of April, 1899, in that month he received only £227; in May, £117; in June, £4502; in July, £25,428; in August, £12,884; and in September, £17,848. Altogether in the six months he received £61,006, which was but a small proportion of the total yearly revenue, which amounted to £219,000. The whole capital was made up of the £51,021; the present value of meters, £6461; office furniture and loose plant, £15,911; tenants' stores, £4929; and bankers' balance for contingencies, £10,000. That gave £88,322 as the total amount which the tenant would require if he were to conduct the undertaking; and 17½ per cent. upon that sum came to £15,400, which, deducted from the £137,840, gave £122,440. The annual sinking fund necessary for renewals was estimated by Mr. Marshall at £15,169, which was obtained by arriving at the present structural value of the Company's entire water undertaking, excluding land. Land did not require renewal; and the figure to be dealt with was £1,516,878, as the total value, excluding land. Deducting £15,169 for sinking fund, being 1 per cent. of the amount, from £122,440, the sum of £107,271 was arrived at, which represented the rateable value of the Company's undertaking, *plus* rates. That contained the service-pipes, mains, reservoirs, and everything; and in order to arrive at the value of the service-pipes, the rateable value of the indirectly contributing plant—viz., £86,918—must be deducted. Taking that from £107,271, the sum of £20,353 was arrived at as the rateable value of the service-pipes of the Company, *plus* the rates.

This concluded Counsel's opening statement.

Mr. *William Marshall*, the Company's Rating Surveyor, was then called. He corroborated the figures mentioned by Mr. Balfour Browne in his opening, and produced various tables and schedules upon which his valuation of £1,500,000 had been based.

Wednesday, Oct. 16.

Mr. *H. E. Jones*, examined by Mr. BALFOUR BROWNE, said he had carefully examined the Grand Junction Water Company's accounts for several years. Their mains extended from Hampton on the South-West to Ealing and Camden Hill on the North-West and North. The average daily supply, taking the maximum month of June, was nearly 22 million gallons; and some 67,000 houses were supplied. There were three reservoirs covering 16 acres, holding 58½ million gallons of water unfiltered, and seven covered reservoirs, with a storage capacity of 76 million gallons, filtered. The filter-beds numbered 21, of a total area of 24½ acres; and there were 479 miles of mains. The aggregate power of the engines was 3716-horse power; and the total capital employed by the Company was £1,822,485. That capital was written down by a large amount, which at one time represented works that were now obsolete or abandoned. Something like £172,000 was written off in 1872. The net receipts, after disallowing the expenditure on rates and taxes, were £137,840; the total receipts being £226,949, adding the water-rents to the recoveries. Deducting the bad debts—viz., £9336, the figure of £217,613 was arrived at; and by adding a portion of the money received from the East London Water Company, that sum was raised to £219,155. Since the great drought, the latter Company were constructing large reservoirs; and it would depend upon how soon they could complete them as to whether they could dispense with assistance or not. When that Company were independent of external sources of supply, there would be no receipts at all such as that. The expenses, including those of management (£15,884), amounted to £82,359. Deducting four-fifths of the expense of pumping the water paid for by the East London Company—viz., £1044—the net expenditure amounted to £81,315.

Mr. BALFOUR BROWNE: Having got your net expenditure, do you proceed to take off an allowance for the tenant?

Witness: Yes; 17½ per cent. on his capital, as arrived at first of all by an examination of the Company's balance-sheets, to see what is the liquid capital actually in the undertaking, then adding the amount for coal and stores, less such stores as belong to the landlord, and taking into account book debts, &c. I make the total value £90,273, allowing £15,797 as the tenant's share, which, deducted from £137,840, gives £122,043.

In further examination, witness said that the works amounted to £789,394, and the service mains and pipes, carrying and pumping mains, valves, and new 24-inch and 30-inch connecting main, to £727,484; making a total for works and mains of £1,516,878. The allowance on that, at 1 per cent., was £15,168, which, deducted from £122,043, gave £106,875 as the rateable value of the whole undertaking, *plus* rates.

Mr. BALFOUR BROWNE: From this figure, you have to take the rateable value of the indirectly contributing portion of the Company's undertaking?

Witness: Yes. The present value of the land is £103,477. On this sum, 4 per cent. gives £4139; the value of the works, buildings, and plant, £789,394, which, at 5 per cent., amounts to £39,470, making the rateable value of the land and works £43,609. To that, I add the average rates paid on the works at 4s. 8d. in the pound—viz., £10,175 making the total rateable value of works and land, *plus* rates, £53,784.

The ARBITRATOR: That is the same as Mr. Marshall's amount, is it not?

Mr. BALFOUR BROWNE: Absolutely, figure for figure.

Witness, continuing, said that 5 per cent. upon the carrying mains and new connecting main—together worth £499,089—came to £24,954,

to which had to be added the average rates at 6s. 1d. in the pound—viz., £7590; making £32,544. The Company's offices and rates thereon were £520; making the total rateable value, *plus* rates, of the indirectly productive portions of the undertaking £86,848, which, deducted from the rateable value of the whole undertaking, £106,875, left £20,027 as the rateable value, *plus* rates, of the service-pipes, equal to 9·20 per cent. of the total water receipts of £217,613. From this might be deduced, according to the income of each parish, the rateable value in all the parishes where no indirect works existed, as follows:—

Parish of St. Marylebone.

Annual water receipts, £7498 at 9·2 per cent. . . .	£689
Less rates at 6s. 10½d. in the £ on rateable value of £530	159
Net rateable value of service-mains	£530
Net rateable value of indirectly productive mains, at 5 per cent. on structural value of £1625	81
Total net rateable value	£611
Add proportion of total maintenance of mains . . .	155
Total gross value.	£766

Parish of St. James, Westminster.

Annual water receipts, £27,199 at 9·2 per cent. . . .	£2502
Less rates at 5s. 4d. in the £ on rateable value of £1976	526
Net rateable value of service-mains	£1976
Net rateable value of indirectly productive mains, at 5 per cent. on structural value of £11,719	£586
Total net rateable value	£2562
Add proportion of total maintenance of mains . . .	736
Total gross value.	£3298

Parish of Paddington.

Annual water receipts, £46,516 at 9·2 per cent. . . .	£4279
Less rates at 5s. 8d. in the £ on a rateable value of £3335	944
Net rateable value of service-mains	£3335
Net rateable value of indirectly productive mains, at 5 per cent. on structural value of £53,913	2696
Total net rateable value	£6031
Add proportion of total maintenance of mains . . .	2139
Total gross value.	£8170

Parish of St. George, Hanover Square.

Annual water receipts, £42,950 at 9·2 per cent. . . .	£3951
Less rates at 5s. 8d. in the £ on a rateable value of £3079	872
Net rateable value of service-mains . . .	£3079
Net rateable value of indirectly productive main 5 per cent. on structural value of £35,046	1752
Total net rateable value	£4831
Add proportion of total maintenance of mains . . .	1362
Total gross value.	£6193

Parish of St. Margaret and St. John, Westminster.

Annual water receipts, £492 at 9·2 per cent. . . .	£45
Less rates at 5s. 5½d. in the £ on rateable value of £36	9
Net rateable value of service-mains	£36
Net rateable value of indirectly productive mains, at 5 per cent. on structural value of £38	2
Total net rateable value	£38
Add proportion of total maintenance of mains . . .	8
Total gross value	£46

Mr. BALFOUR BROWNE: With regard to your renewal fund, you allow 1 per cent. on the capital value as a renewal fund?

Witness: Yes.

Suppose any real renewals are done in this particular year, that would be done out of revenue?—Yes.

Under those circumstances, what would you do with the renewals?—They would have to be deducted from the 1 per cent.

And that is what has been done in this particular case?—Yes.

In the absence of Mr. Frederick Marshall, the cross-examination on behalf of the parish of St. James, Westminster, was postponed. Mr. Jones was, however, cross-examined by Mr. English Harrison (Marylebone), Mr. Danckwerts (Paddington), and Mr. Ryde (St. George's, Hanover Square). Their cross-examination was directed to show that the basis upon which the tenant's capital had been calculated was not correct—too much allowance having been made for the cash outlay; and that the amount of the renewal fund of 1 per cent. on the capital value of the whole undertaking was excessive. The learned Counsel also took exception to the allowance made by the witness for the expenditure on the lowering of the mains caused by the frost of 1895. Reference was further made to the calculation of the receipts from the East London Water-Works Company, and to the suggested average life of the engines and works.

Thursday, Oct. 17.

Mr. *E. H. Bousfield*, of the firm of Edwin Fox and Bousfield, examined by Mr. SNAGGE, said he had inspected the general works of the Company and the land occupied by them, and had had an opportunity of conferring with Mr. William Marshall and Mr. Walter Hunter in regard to the figures placed before the Arbitrator. His judgment coincided with theirs.

Mr. SNAGGE: Dealing first with the land, what principle have you adopted in arriving at the value of that?

Witness: I have looked at the value of the land to the Company.

With regard to the buildings and plant, do you consider that Mr. Marshall's basis is the correct one?—Yes; I agree, as to the plant and machinery, with the figures of Mr. Marshall and Mr. Jones.

What is the principle you have adopted to get at the rateable value?—I have taken 4 per cent. interest on the capital value of the land, and 5 per cent. on works, buildings, and plant; these figures having been laid down for adoption in cases like this.

And then in order to get at the gross value?—I add one-fourth to the rateable value in most instances, which is equal to about 1 per cent. on the reservoirs, 1½ per cent. on the structural value, and 2 per cent. on the plant. In regard to rateable value, I agree with the figures given by Mr. Marshall.

In cross-examination by Mr. F. MARSHALL, witness said he had in all cases accepted Mr. William Marshall's measurements and values. He was not an expert in valuing plant and machinery; but from his large experience, he had a general knowledge of the subject.

Mr. *William Marshall* was then recalled, and cross-examined in regard to his method of valuing the pipes and machinery. He stated that he had accepted the valuation of the pipes prepared by Mr. Hunter, the Engineering Director to the Company. He had estimated the value of the machinery and engines on the basis of what they were worth to the Company.

The cross-examination, which involved a large mass of details, lasted the whole of the remainder of the day.

Friday, Oct. 18.

Mr. *W. Marshall* was further cross-examined by Mr. RYDE as to his method of arriving at his valuation.

Mr. *Walter Hunter*, examined by Mr. BALFOUR BROWNE, said he was responsible for the figures supplied to Mr. Marshall, and included in his tables. Since the appeal to the Sessions, the estimate of rateable value of the different parishes had been revised; and the Oxford Street main, which had formerly been taken as entirely within the parish of Marylebone, had been divided among three parishes. He agreed with Mr. Marshall in allowing 25 per cent. for depreciation on the £8615, the value of the meters, though that might be a large allowance. It was certainly necessary to provide 1 per cent. of the total capital of the Company for renewals, in case of plant becoming obsolete and requiring replacing. The life of plant, of course, varied considerably. In 1891, a pumping-engine was erected at Hampton at a cost of £6500; and in 1899 it cost £4000 for repairs and part renewal. As the result of the frost of 1895, 92 miles of mains were relaid at a lower level, out of a total of 499 miles, extending over 39 square miles.

In reply to the ARBITRATOR, who asked how he discriminated between mains and service mains, witness said that 3, 4, or 5 inch pipes were service-mains, and 6 inches and above indirect mains. He would not say that mains earned no money; but if they did, it was only in exceptional cases.

Mr. F. MARSHALL then cross-examined the witness in regard to the value of the several items in his tables. Questioned as to the superiority of new as against old engines, Mr. Hunter was doubtful of the former being more economically worked. At present, they had an old Cornish engine which pumped to a height of 100 feet at 12s. per million gallons, and a Worthington engine at Hampton cost 14s. 9d. The extensive repairs on the engine referred to were necessary in consequence of it becoming out of line, the cylinders were worn, new pistons were required, and because of the engine working at too great a speed the pump was altered.

A consultation took place between the Arbitrator and Counsel, as the result of which it was agreed to continue the inquiry on the following day, and to then adjourn until the 4th prox.

Mr. DANCKWERTS reminded the Arbitrator that the Court had fixed the 7th prox. as the date for the presentation of the report.

Mr. PAGE said it would be necessary to make application for the extension of the time allowed for the inquiry. He wished to inspect the works, and would prefer making the inspection at the conclusion of the respondent's case. The report could be presented at the end of November.

Mr. BALFOUR BROWNE: The time could be extended until the end of the year.

Mr. PAGE: I think in this instance it would be rather a bad thing to have it extended over December, because then we should all feel that we had the other month in which to complete the case.

Saturday, Oct. 19.

Mr. *Hunter* was cross-examined by Mr. ENGLISH HARRISON (for Marylebone) in regard to the situation of the 24-inch main in Oxford Street, which had been returned as being in the Parish of Marylebone, and on revision distributed between the three parishes of Paddington, St. George, and St. James. Witness explained that the whole of the roadway was kept in order by Marylebone; and it was understood that it was entirely within their jurisdiction. It was recently discovered, however, that the parish boundary ran along the centre of Oxford Street; and as the main was south of the centre, it was in the parishes of St. George, Hanover Square, and St. James, Westminster. With regard to the portion between Lancaster Gate and Marble Arch, even the St. George and Paddington parishes, who were concerned, could not agree as to which parish had jurisdiction over the particular ground traversed by the pipe.

In reply to Mr. DANCKWERTS, witness said his Company had debited the East London Company with £3 per million gallons for the water supplied during the famine in East London. This represented merely the cost of pumping and filtration.

Witness was re-examined by Counsel for the appellants; and the inquiry was then adjourned until Nov. 4.

Quality of Faversham Gas.—At the meeting of the Faversham Town Council last Tuesday, a report on a test of the gas supplied by the Gas Company was read, which showed that the illuminating power was only 12·3 instead of 15 candles. The test was made on the previous evening by Mr. W. J. Dibdin; and it was decided, upon his report, to take proceedings against the Company.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

On Tuesday last, there was inaugurated at Johnstone a scheme of gas extension which is of more than usual interest. Johnstone was one of the first places to adopt the Burghs Gas Supply Act of 1876. In 1879, the gas undertaking came into the hands of the Corporation; and it is the management of the Corporation which gives point to the doings of the present day. After getting hold of them, the works were brought up to date, at considerable expense. The capital outlay was about £23,000. It has been found that at the end of 22 years the works are greatly behind the age; and, coupled with this, that they are far too small to supply the wants of the community. But it has also been found that the Corporation have repaid capital to the amount of over £13,000; and therefore, when the question of extending the works arose as a crying one, the Corporation were in a position financially to spend a large sum in altogether modernizing them. The result is a gas-works with which there is none to compare in Scotland, in anything of the same class. I would not go the length of saying that 22 years constitute the lifetime of a gas-works; but the reflection is permissible that works which were up-to-date 22 years ago, are to-day very far behind, and require renewal. In how many places is the owning body able to renew them, as has been done in Johnstone? Judicious corporation management comes in here. By carefully nursing the business, watching for new outlets for gas, and the like, the Commissioners, as the business expanded, were able both to reduce the price of gas and redeem capital. A proprietary gas undertaking might have done the former; but the latter it is not the custom to do. Herein corporation management has a great advantage over company management. As an instance of judicious corporation management, I may mention that Johnstone was one of the first places to introduce the practice of supplying gas-grills free to consumers. The population is largely an industrial one, to whom it is of great advantage to have a means of raising heat quickly at meal hours. Getting the use of the griller free, and the Corporation workmen fitting it up without charge, scarcely any workman's house is without one. There are 800 grillers in use, with 750 prepayment meters, and the number of cookers on hire is only about 30. There are also some 30 gas-engines. In June, the day consumption is greater than that of the evening. To enable them to meet the requirements of a rapidly growing business, the Commissioners have, on the advice of Mr. J. M'Gilchrist, of Dumbarton, who has been their Consulting Engineer since they acquired the undertaking, expended about £10,000 in reconstructing the works. All that has been brought into use now is of the most modern description, when the wants of a place of the size are taken into account. The financial burden is light, and will be getting lighter year by year. I have spoken of the Commissioners having judiciously conducted the undertaking; but I must not forget that the Manager (Mr. R. L. Deans) has been responsible for the policy which the Commissioners have adopted. The Commissioners have had the wisdom to place confidence in Mr. Deans during the many years he has been in Johnstone; and this has been requited by splendid service. Mr. Deans is now in a position to do better work than ever; and, judging from past experience, I reckon there is little doubt that he will rise to the occasion, and continue to make the excellent record he has made in the past.

The Corporation of Glasgow, at their meeting last Thursday, were forced by Bailie D. M. Stevenson into a consideration of the question of Sunday labour. Bailie Stevenson gives an onlooker the notion that he is a man who would be disappointed if he should find himself in harmony with everyone else. In this instance, he was confessedly airing the grievances of the tramway and cleaning employees. The position was that it did not matter what it might cost the Gas Committee, they should not be allowed to take the course they suggested, because the men in the Tramways and Cleaning Departments might be discontented. But these three services cannot be compared one with the other. The alternative before the Council was whether they would spend £30,000 a year upon providing an extra shift of retort-men, or should pay their present men £1250 a year more than at present, for a moderate amount of labour on Sundays. Needless to say, they chose the latter. The Gas Committee is a strong one, well led; and truly, as Mr. Mitchell stated, they are capable of managing their own affairs. Everyone believes that—except, perhaps, Bailie D. M. Stevenson.

The Gas Committee of the Dundee Town Council have, on the recommendation of the Engineer and Manager (Mr. W. M'Crae), resolved to give a trial to the policy of furnishing consumers with gas-burners free of charge. It has been found that in the majority of cases, where complaint has been made as to defective gas lighting, the trouble has been due to bad burners. This accords with experience elsewhere.

On Tuesday, the Town Council of Peebles had before them the gas accounts for the past year. Provost Ballantyne stated that the revenue was £5031, made up as follows: From gas, £4193; from residuals, £709; from cooker-rents, £99; and from other sources, £30. The revenue was about £2000 more than it was when the Commissioners acquired the undertaking. The expenditure was £5021, which left a balance of £10 in favour of the Corporation. They anticipated that the reduction in the price of coal this year would mean a very different state of matters at the end of the twelve months, notwithstanding the lowering of the price of gas to the amount of 5d. per 1000 cubic feet. The make was 22,351,700 cubic feet—an increase of 16·5 per cent. over the preceding year, and of 51·7 per cent. over the year before that. Since the Corporation purchased the undertaking, two years ago, the sales had risen from 12,464,200 cubic feet to 20,326,300 cubic feet. He thought this was a very remarkable increase; and as the town was growing, he had no doubt that, although they might not be able to keep up the rate of increase, they would have a steady rise in the consumption of gas. There were now 667 large cookers, and 138 grillers in use, with a corresponding number of prepayment meters. There was also an increasing number of gas-fires in use. He regarded it as tolerably certain that, as regarded cookers and meters, they were still leading the van. They had now only about 380 ordinary meters out.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 1027.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME	Closing Prices.	Rise or Fall in Wk	Yield upon Investment.
£			p.c.	GAS COMPANIES.			£ s. d.
590,000	10	Oct. 11	10½	Alliance & Dublin 10 p.c.	19—20*	..	5 5 0
100,000	10	,,	7½	Do. 7 p.c.	12¾—13¼*	..	5 11 1
300,000	100	July 1	5	Australian 5 p.c. Deb.	100—102	..	4 18 0
200,000	5	May 15	6½	Bombay, Ltd.	6¼—6⅝	..	4 16 4
40,000	5	,,	6½	Do. New, £4 paid	4⅜—4½	..	5 9 5
380,000	Stk.	Aug. 15	12	Brentford Consolidated	265—270	..	4 8 11
270,000	,,	,,	9	Do. New	192—197	..	4 11 5
50,000	,,	,,	5	Do. 5 p.c. Pref.	130—135	..	3 14 1
206,250	,,	June 14	4	Do. 4 p.c. Deb.	114—117	+1	3 8 5
220,000	Stk.	Sept. 12	10	Brighton & Hove Orig.	222—227	..	4 8 1
246,320	,,	,,	7	Do. A. Ord. Stk.	155—160	..	4 7 6
1,047,500	Stk.	Aug. 28	5	Bristol, 5 p.c. max.	118⅜—119½	..	4 3 8
420,000	20	Sept. 27	10	British	41—42	..	4 15 3
50,000	10	Aug. 15	12	Bromley, Ord. 10 p.c.	24—26	..	4 12 4
82,850	10	,,	9	Do. 7 p.c.	19—21	..	4 5 8
500,000	10	Oct. 11	6	Buenos Ayres (New) Ltd.	8⅞—9¼*	..	6 9 9
220,000	Stk.	June 28	4	Do. 4 p.c. Deb.	96—98	..	4 1 8
150,000	20	July 17	8½	Cagliari, Ltd.	22—24	..	6 17 6
100,000	10	Sept. 27	10	Cape Town & Dis., Ltd.	14⅜—15½	..	6 9 0
50,000	50	May 2	6	Do. 6 p.c. 1st Mort.	53—55*	..	5 9 1
550,000	Stk.	Oct. 11	12	Commercial Old Stock	270—275*	..	4 7 3
236,425	,,	,,	9	Do. New do.	203—208*	..	4 6 7
238,237	,,	June 14	4½	Do. 4½ p.c. Deb.	130—135	..	3 6 8
800,000	Stk.	May 31	9	Continental Union, Ltd.	163—168	..	5 7 2
200,000	,,	,,	7	Do. 7 p.c. Pref.	162—167	..	4 3 10
575,000	Stk.	Aug. 29	5	Crystal Palace Ord. 5 p.c.	122—127	..	3 18 9
60,000	,,	,,	5	Do. 5 p.c. Pref.	123—128	..	3 18 2
486,090	10	July 17	10½	European, Ltd.	19—20	..	5 5 0
354,060	10	,,	10½	Do. £7 10s. paid	14—15	..	5 5 0
15,079,885	Stk.	Aug. 15	4 5/16	Gas-light and Coke	4 p.c. Ord.	96—98	−1	4 9 9
2,600,000	,,	,,	3½		3½ p.c. max.	88—90	..	3 17 9
3,799,735	,,	,,	4		4 p.c. Con. Pref.	111—114	..	3 10 2
4,063,425	,,	June 14	3		3 p.c. Con. Deb.	91—93	..	3 4 6
70,000	10	May 31	8	Hongkong & China, Ltd.		13½—14½	+½	5 10 4
3,800,000	Stk.	May 15	10	Imperial Continental		213—216	..	4 12 7
473,600	Stk.	Aug. 15	3½	Do. 3½ p.c. Deb. Red.		100—102	..	3 8 8
561,000	Stk.	Aug. 29	10	Liverpool United A		229—232	..	4 6 2
718,100	,,	,,	7	Do. do. B		170—172	..	4 1 5
306,083	,,	June 28	4	Do. do. Deb. Stk.		119—120	..	3 6 8
75,000	5	June 14	4	Malta & Medn., Ltd.		4¼—5	..	4 0 0
560,000	100	Oct. 1	5	Met. of	5 p.c. Deb.	104—107	..	4 13 6
250,000	100	,,	4½	Melbourne	4½ p.c. Deb.	102—104	..	4 6 7
541,920	20	May 31	3½	Monte Video, Ltd.		9—10	..	7 0 0
717,946	Stk.	Aug. 3	8½	Newc'tle & G'tesh'd Con.		224—226	..	3 15 3
312,855	Stk.	June 28	3½	Do.	3½ p.c. Deb.	97—99	..	3 10 8
150,000	5	May 15	8	Oriental, Ltd.		7⅞—8¼	..	4 17 5
135,000	5	,,	8	Do. New, £4 10s. pd.		7—7⅛	..	4 16 0
15,000	5	,,	8	Do. do. 1879, £1 pd.		1¼—1⅜ *Ex. div.	..	4 11 5

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.	GAS COMPANIES.			£ s. d.
60,000	5	Sept. 27	7	Ottoman, Ltd.	5⅞—6⅛	..	5 12 0
851,070	10	Oct. 11	7	River Plate Ord.	10⅝—11*	..	6 7 3
250,000	Stk.	June 28	4	Do. 4 p.c. Deb.	96—98	..	4 1 8
250,000	10	Sept. 27	8	San Paulo, Ltd.	11—12	..	6 13 4
135,000	Stk.	Sept. 12	10	Sheffield A	240—243	..	4 2 4
209,984	,,	,,	10	Do. B	240—243	..	4 2 4
523,498	,,	,,	10	Do. C	240—243	..	4 2 4
5,761,885	Stk.	Aug. 15	5	South Met., 4 p.c. Ord.	124—126	..	3 19 4
1,627,965	,,	July 17	3	Do. 3 p.c. Deb.	91—94	..	3 3 10
380,940	Stk.	May 15	5	Southampton Ord.	107—112	..	4 9 3
70,825	,,	July 17	4	Do. 4 p.c. Deb.	104—109	..	3 13 5
120,000	Stk.	Aug. 29	5½	Tottenham and Edmonton	A. 5 p.c.	122—127	+2	4 6 8
250,520	,,	,,	4		B. 3½ p.c.	95—100	+5	4 0 0
182,380	10	Jan. 16	5	Tuscan, Ltd.	8—9	..	5 11 1
149,900	10	July 1	5	Do. 5 p.c. Deb. Red.	95—100	..	5 0 0
230,000	5	Aug. 15	9	West Ham, 10 p.c.	9⅝—10⅜	..	4 5 9
172,000	10	,,	6	Do. 7 p.c.	12⅜—13⅝	..	4 8 11
140,900	Stk.	June 28	4	Do. 4 p.c. Deb.	107—112	..	3 11 5
				WATER COMPANIES.			
780,599	Stk.	June 28	11	Chelsea, Ord.	312—317	+2	3 9 5
150,000	,,	,,	5	Do. 5 p.c. Pref.	152—157	..	3 3 8
160,000	,,	,,	4½	Do. 4½ p.c. Pref. '75	140—145	..	3 2 1
175,785	,,	Sept. 27	4½	Do. 4½ p.c. Deb.	140—145	..	3 2 1
1,720,560	Stk.	Oct. 11	7	East London, Ord.	200—205*	..	3 8 4
654,740	,,	June 14	4½	Do. 4½ p.c. Deb.	143—148	..	3 0 10
1,018,046	,,	,,	3	Do. 3 p.c. Deb.	96—98	+1	3 1 3
700,000	50	June 14	8	Grand Junction	10 p.c. max.	115—118	+3	3 7 10
310,000	Stk.	Sept. 27	4		4 p.c. Deb.	122—126	..	3 3 6
708,000	Stk.	Aug. 15	14	Kent		290—295	..	4 14 11
160,000	,,	,,	7	Do. New, 7 p.c. max.		200—205	..	3 8 4
1,043,800	100	June 28	10½	Lambeth, 10 p.c. max.		298—303	+1	3 9 4
406,200	100	,,	8	Do. 7½ p.c. max.		217—222	+2	3 12 1
350,000	Stk.	Sept. 27	4	Do. 4 p.c. Deb.		125—130	..	3 1 7
500,000	100	Aug. 15	12 5/16	New River, New Shares		395—405	..	3 3 2
1,000,000	Stk.	July 31	4	Do. 4 p.c. Deb.		125—130	..	3 1 7
902,300	Stk.	June 14	6	South-wark and	Ord.	198—203	+1	2 19 1
126,500	100	,,	6		7½ p.c. max.	182—187	..	3 4 2
489,200	Stk.	,,	5		5 p.c. Pref.	147—152	..	3 5 9
1,019,585	,,	Oct. 11	4	Vauxhall	4 p.c. A Deb.	124—129*	..	3 2 0
1,155,066	Stk.	June 14	10	West Middlesex		290—300	..	3 6 8
200,000	,,	,,	4½	Do. 4½ p.c. Deb.		138—143	..	3 2 11
200,000	,,	Sept 12	3	Do. 3 p.c. Deb.		94—97 *Ex. div.	..	3 1 10

He thought they might consider that, taking into account the high price of coal, they had done very well. The accounts were approved.

At the same meeting, the Town Clerk read a letter from the proprietors of the ground upon Eshiels Farm, upon which it is proposed to erect new works, to the effect that they had a natural reluctance to feu ground for the erection of a gas-works; and they proposed that the duty to be charged should be at the rate of £20 per acre. The Council agreed to pay this price. As five acres are to be taken, the annual burden for feu-duty will be £100.

The gas accounts for the past year were recently presented to the Corporation of Elgin by Mr. Jameson, the Burgh Treasurer. There was complaint that they had not previously been laid before the Gas Committee; but this, it was explained, was omitted to be done because of want of time. The circumstance had the effect, however, of preventing the members, other than those of the Finance Committee, giving the subject intelligent consideration. It appeared that a year ago the Council estimated a deficit of £837, to meet which they raised the price of gas from 4s. 2d. to 4s. 7d. per 1000 cubic feet; and that there had been an increase in the consumption of 1,842,900 cubic feet during the year, by reason of which the deficit had been more than made up. The price to ordinary consumers was continued at 4s. 7d. per 1000 cubic feet. To consumers through prepayment meters, it was reduced by 1d., making the price 5s. per 1000 cubic feet. About £600 has been spent in improvements, and the Gas Committee are to consider whether this is to be charged against revenue or capital.

In my "Notes" in the "JOURNAL" for the 8th inst., I referred to the fact that Mr. G. Keillor, jun., the Manager of the Peterhead Gas-Works, was experimenting with incandescent burners for street lighting. It appears from a local paper that at several conspicuous points in the town lamps of extra power have been erected; among them being a Scott-Snell self-intensifying high-pressure lamp. Single and double burner incandescent lights have been put up in several places, greatly improving the illumination. In one street alone a saving of from £5 to £7 per annum is reckoned upon.

Lord Kyllachy's opinion in the action with reference to alleged infringement, brought by the Welsbach Incandescent Gaslight Company against an Aberdeen man and his wife, is of more than passing interest. He refuses to deal with the case otherwise than by its being fully proved before him. The contention of the Company is that they have proved their case in a Court in London, and have received a certificate of the validity of their patent, which every other Court in the United Kingdom is bound to accept; and that all that is now necessary is to prove that mantles which are an infringement have been sold. To all appearance, Lord Kyllachy is going to re-try the whole question. Patentees everywhere have an interest in this matter; because if they are to be exposed to the burden of proving the validity of their patent every time it may be infringed, in many instances the patent would not be worth possessing. The Welsbach patent is eminently such alone. The Company maintain a constant war with people whom they accuse of infringement. They nearly always, if not always, succeed against the individuals whom they arraign; but the trouble springs up again immediately afterwards. The course of action to be followed by the Company should be clear; and it should be as nearly as possible the same in all cases. But that there is not uniformity of practice is shown by the fact that to-day Lord Pearson, in the Court of Session, granted perpetual interdict, without proof, against other two persons.

A settlement has been effected of the action before Lord Stormonth-Darling in the Court of Session, in which the Magistrates of Perth, as Gas Commissioners, sued Hugh Symington and Sons, Contractors, of Coatbridge, for £1104 13s. 6d., as due in connection with a contract for the preparation of the site for the new gas-works, and for £1000 as damages for alleged breach of contract. A report of the action was published in the "JOURNAL" for Dec. 11, 1900 (p. 1463). Part of the work executed by Messrs. Symington was the erection of a retaining wall. That wall, it was contended, was not built according to the specification and plan; and the Commissioners expended £500 in repairing and strengthening it. They maintained also that they had overpaid the Contractors to the amount of £604 13s. 6d. The defendants said that the work, while it was in progress, was constantly under the supervision of the Clerk of Works, and was frequently seen and examined by the Engineer; and no objections were taken to them. The work was completed before the new Engineer was appointed; and he differed in his opinions as to the erection of the works from the old Engineer. They denied that the work was not executed according to contract; and they reserved their right of action against the Commissioners for the libellous statements made by the pursuers. Evidence was to have been led in the case on Tuesday next; but it has been compromised and taken out of Court. The terms of settlement include a payment by the Contractors, and the withdrawal of the allegations made against them by the Commissioners.

Projected Extension of the Aberavon Gas-Works.—The Town Council of Aberavon have resolved to engage the services of Messrs. Thomas Newbigging and Son to prepare plans and estimates for the erection of new gas-works. Mr. Arthur Bond, the Manager, has advised the Council that this is absolutely necessary, as the existing works are too small and antiquated to supply the present demands. For years the works have been carried on at a loss to the ratepayers; and the burden is becoming annually greater. It is hoped that the new works may be commenced early in the coming spring.

A Joint Water Scheme Projected for the Neath District.—At last Wednesday's meeting of the Aberavon Town Council, a recommendation of the Water Committee to adopt the Ystradfellte Water Scheme, as propounded by the Neath Rural District Council, was carried with only one dissentient. The scheme involves the Council in a maximum expenditure of £25,000 for obtaining water from Ystradfellte, in the Vale of Neath. The Council agreed to join with the Neath Rural District Council in the promotion of a Bill in the next session of Parliament to carry out a comprehensive scheme of water supply which embraces the whole area of the Neath Rural District Council. The estimated cost is £175,000; Aberavon's share to be not more than £25,000.

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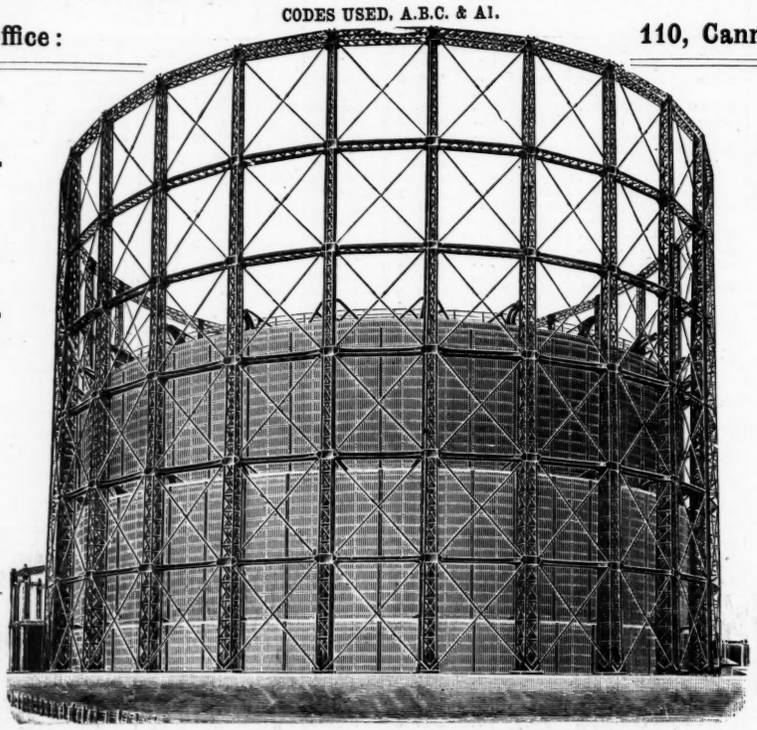

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CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Oct.* 19.

Sulphate of Ammonia.—There has been a firm market, and all supplies for prompt delivery have been readily absorbed. The closing quotations are £10 11s. 3d. to £10 12s. 6d. per ton f.o.b. Hull, £10 15s. per ton f.o.b. Leith, and £10 18s. 9d. per ton f.o.b. Liverpool. The larger makes are mostly being delivered against contracts made in advance; and while speculators have been waiting to cover their further requirements, the bulk of the smaller makes is being taken by consumers direct. There has been buying over near months at a small premium on spot prices; and further ahead buyers' ideas have been approximating those of makers, but as yet they have hardly come up to makers' prices. London, Beckton terms, is quoted £10 15s. per ton, and Leith, ordinary terms, January forward, £11 2s. 6d. to £11 5s. per ton.

Nitrate of Soda is steady at 9s. 3d. to 9s. 4½d. per cwt., according to quality, on spot. The forward position is firm; but there is little business passing.

LONDON, *Oct.* 19.

Tar Products.—Pitch continues in very strong demand, especially for prompt delivery; and very high prices have been paid for shipment from London. It is felt, however, that this extreme pressure is only temporary, and that as the make increases the supply will be fully equal to the demand. Sales of Beckton are reported at as high as 34s.; this being for immediate shipment. Ninety per cent. benzol has again been sold at 9½d. London; but business is decidedly limited, as is the case with 50 to 90 per cent., in which small sales have been made for home consumption at 9½d. Carbolic acid is still firm for early delivery; there being evidently a fairly good demand. But as regards forward business, there is nothing to report. Crystals are decidedly depressed, and sales are believed to have been made at under the prices quoted by the manufacturers. Creosote continues firm in London, where the demand is good; but prices in the North are still dull. Several parcels have been placed for prompt delivery at exceptionally low prices, simply to relieve stock. Tar values remain stationary. There is nothing of importance to advise.

The average values obtaining during the week are: Tar, 14s. 6d. to 17s. 6d. Pitch, east coast, 32s. to 32s. 6d.; London, 33s. to 34s.; west coast, 30s. 6d. to 31s. Benzol, 90's, 9¾d.; 50's, 9½d. Toluol, 10d. Crude naphtha, 4¼d. Solvent naphtha, 10½d. to 11½d. Heavy naphtha, 10d. to 11d. Creosote, North, ¾d. to ⅞d.; London, 1⅛d. Heavy oils, 2d. Carbolic acid, 60's, 1s. 10½d. to 2s. Naphthalene, 60s. to 80s.; salts, 35s. to 45s. Anthracene, "A," 2¼d. to 2½d.; "B," unsaleable.

Sulphate of Ammonia.—The market remains quiet. There appears to be an absence of business, although there is a better inquiry forward. The Gaslight and Coke Company still quote £10 15s. for October-December, but do not find buyers; £10 10s. having been accepted, Beckton terms. In Hull, sales have been made at £10 12s. 6d. for immediate shipment, and at £10 15s. for November-December. In Leith, business is still being done at £10 15s. prompt. This port appears to be the strongest market at present. For prompt shipment, Liverpool, £10 15s. has been paid; but a little less than this has been accepted for discoloured.

[By a clerical error, the price of creosote in the North last week was given as ⅜d. instead of ¾d. per gallon.]

COAL TRADE REPORTS.

Lancashire Coal Trade.—Although there is still no pressure of demand, all descriptions of round coal continue to meet with a ready sale, much as reported recently. With few exceptions, pits are working practically full time, and are mostly moving away their output; stocks remaining almost stationary. Prices are strong at recent quotations, best house-fire coals averaging 15s. per ton, seconds 13s. to 13s. 6d., common 11s. to 11s. 6d., and steam and forge coals about 9s. at the pit. Engine fuel remains the chief difficulty with colliery owners; and supplies continue in excess of requirements. The market is to a large extent unsettled by the competition of low-priced surplus supplies which are coming in from outside districts—Derbyshire more particularly; and this is tending to weaken the position of local coalowners. Common Lancashire slacks could now be bought on contract at about 5s. per ton, and on ordinary current sales at about 5s. 6d. Collieries in some instances are prepared to contract in the better qualities at as low as 6s. 6d., with current quotations about 7s. to 7s. 6d. at the pit. Good Derbyshire slack has been sold in fairly large quantities recently in this district, on the basis of about 3s. 6d. per ton at the pit; and inferior sorts can be bought as low as 2s. 6d. The shipping trade continues fairly good, with prices firm at late rates; ordinary qualities of steam coal fetching about 10s. 3d. to 10s. 6d. per ton, and house-fire qualities about 13s. to 13s. 6d. upwards, delivered at the Mersey ports. Coke is in fairly active request, with a steady tone as regards prices; but any further upward move would, for the present at any rate, seem to be checked, as the increased production is now evidently meeting requirements. Best Lancashire foundry cokes remain at 24s. to 25s. per ton; good washed furnace sorts ranging from 14s. to 15s. at the ovens.

Northern Coal Trade.—There is a good demand for gas coals; but steam sorts are quieter and lower. Best Northumbrian steam coals are now from 11s. 3d. to 11s. 6d. per ton f.o.b.; and steam smalls are steady at 5s. 3d. to 5s. 6d.—the latter quality being less abundant, as more coals are being sold in the unscreened condition. Manufacturing coals are steady; but the supply is plentiful. Coking coals are rather firmer, without change in the price. In gas coals, there is a full demand, though the shipments to the northern ports of the Baltic are now ended for the season. The deliveries on contract are now increasing; and the production is thus mainly taken up, leaving little for occasional sales. The latter are thus few, and high prices are asked for the best qualities—up to 12s. 9d. per ton f.o.b. having had to be paid to secure a supply of best Durham gas coals. Best Durham coke is steady at 18s. to 18s. 6d. per ton f.o.b. Blast-furnace coke is

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16s. 9d. per ton at the Teesside furnaces. Gas coke is in fuller supply; but stocks seem to be kept down, and prices are as quoted last week. It needs to be added that the high prices quoted for gas coals, together with the tax added, are driving some Hamburg contracts to Westphalian collieries.

Scotch Coal Trade.—A period of dulness seems to have set in. There has been so long an expectation that coal would get cheaper, that buyers have not contracted ahead. Coal has come down considerably in price; but the forward demand has not improved proportionately. The prices quoted are: Main 9s. to 9s. 3d. per ton f.o.b. Glasgow, ell 10s. 3d. to 11s. 3d., and splint 10s. 9d. to 11s. The shipments for the week amounted to 194,735 tons—a decrease of 22,331 tons upon the previous week, and of 49,888 tons upon the corresponding week of last year. For the year to date, the total shipments have been 7,723,614 tons—a decrease of 999,089 tons upon the same period of last year.

Skipton Water Supply.—Some short time ago, the Skipton Urban District Council consulted Mr. G. H. Hill, with respect to the advisability of having the Eastby water conveyed into the present reservoir at Skipton. Mr. Hill's report (presented to the Water Committee at a special meeting on Monday last week) demonstrated that a scheme for conveying the Eastby water into the present reservoir was impracticable, and that more storage was required. This was reported to a meeting of the Council on Thursday, and a resolution was proposed that the Council should go into Committee upon the question. Mr. Hargraves said that at such a stage as the present—when the public were taking such an interest in the water supply, and seeing that a sum of money had been spent in obtaining the advice of an Engineer—he thought some particulars of the latter's report, and of the discussion now about to take place on the matter, should be taken in open Council. The resolution to go into Committee was, however, decided upon.

The Proposed Water-Works Purchase at Beverley.—At last week's meeting of the Beverley Town Council, the Parliamentary and General Purposes Committee reported the receipt of a letter from the Secretary of the Water Company offering terms for the purchase of the water-works. He said: "The Directors are unwilling sellers of the Beverley Water-Works; but if the Corporation press to purchase, they [the Directors] might agree to sell on the following conditions: (1) £10 for ordinary shares of £10; (2) 5 per cent. per annum on the above capital guaranteed from the commencement; (3) 10 per cent. allowed to the Company for forced sale; (4) all balances of account for extension work to be paid by the Corporation; (5) all law expenses, &c., connected with the sale and winding up to be paid by the Corporation; (6) the mortgage stock and preference stock, not being redeemable, must be treated separately. As to affording greater facilities for street watering, the Company consider that 6d. per 1000 gallons is a fair price to charge; and they also agreed to allow the use of their hydrants subject to the Corporation finding the necessary stand-pipes and hose, and paying the Company for all necessary repairs." The matter was referred to the Council in Committee.

New Water-Works for Colne.—Last Wednesday the members of the Colne Corporation proceeded to the pumping-station and bore-hole at Wycollar, and formally took possession of the machinery and station. The yield during the whole of the time has been 400,000 gallons of water daily. The Mayor of Colne, in acknowledging the presentation of a silver tankard to commemorate the occasion, said they looked upon the test as conclusive that the supply of water from the station would postpone for many years the construction of a reservoir, and effect a saving of £50,000.

Water-Works Extension at St. Helens.—Last Wednesday Colonel A. G. Durnford, R.E., held an inquiry, on behalf of the Local Government Board, into an application by the St. Helens Corporation for sanction to borrow £30,000 for the construction of a new reservoir at Brown Edge. The Town Clerk (Mr. G. W. Bailey) stated that the Corporation could borrow £150,000 for water-works purposes; and of this sum £94,274 remained unaffected by previous applications. For a long time the Corporation had been impressed with the urgency of providing better service reservoir accommodation. They were not thoroughly independent of possible interruptions of service from the pumping-stations; while the present reservoir accommodation was extremely small, and in no sense formed a stand-by against possible contingencies—they had occasional breakdowns and bursts. These had not as yet been serious; but they never knew how soon a grave catastrophe might take place. The land for the reservoir had been secured at 1s. 6d. a yard freehold, which was quite reasonable, in view of the fact that in 1868 the land for the existing reservoir and softening works was bought for 1s. 8d. a yard, while land in the locality had recently changed hands at 2s. 6d. a yard. The Water Engineer (Mr. J. J. Lockland) then explained the scheme; and the inquiry concluded without opposition being offered.

Proposed Extensions at the Cardiff Water-Works.—The subject of the extension of the storage capacity of the Cardiff Water-Works was under discussion by the Water Committee of the Corporation at a recent meeting. The Engineer (Mr. C. H. Priestley) pointed out that it would be unsafe to delay beyond 1903 the construction of No. 3 reservoir in the Taff Fawr series unless other storage were provided. After some discussion, it was decided to recommend the Council to invite Mr. J. A. B. Williams, who had devised the Taff Fawr scheme, and Mr. Priestley to report upon the following points: (1) Whether it was necessary that the proceedings should be taken at once towards the construction of the third reservoir in the Taff series, and whether, in the event of a drought of 150 days, it would be safe to fall back upon reservoir No. 1 or No. 2 for compensation water. (2) Could the embankment of No. 2 reservoir be raised 6 feet, and would the enlargement justify the expense of such work? (3) Could another reservoir be constructed at Llanishen, and filled with water from the Taff Fawr by means of the existing main? (4) If it should be necessary to enlarge the proposed size of No. 3 reservoir in the Taff series, how much more land would it be necessary to acquire to give a storage capacity of 850 million gallons? (5) That approximate costs be given in each case.

WRIGHT'S GAS FIRES.

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Tenby Water Supply.—The Local Government Board have refused sanction to the borrowing of £16,000 by the Tenby District Council, for a scheme involving the use of the Pritec water as a permanent source of supply. The Board are prepared to entertain an application for sanction to a loan for the execution of so much of the works as in their opinion would be likely to be serviceable in connection with some other satisfactory supply, if the Council will proceed without delay.

Birmingham Water Supply.—At the meeting of the Birmingham City Council to-day, the Water Committee will present a report in which they will give some interesting details in regard to the undertaking under their control. They state that the total consumption during the half year to the 30th ult. shows a considerable increase over the corresponding period of 1900; having averaged 19,200,000 gallons per day, against 18,100,000 gallons last year. The maximum day this year showed a consumption of 24,297,000 gallons, as compared with 23,588,000 gallons in 1900. With the exception of a few days at the end of July, when there was shortage in some districts, the supply was well maintained throughout the summer. The rainfall, although considerably below that of last year in total, has nevertheless been well distributed; there having been no prolonged drought. With regard to the Welsh scheme, good progress was made during the summer with the works in the Elan Valley, and on the various sections of the aqueduct, also at Frankley, and in connection with the laying of the distribution mains. As already mentioned in the "JOURNAL" (*ante*, p. 932), it is proposed to apply to Parliament for an extension of time for the completion of the first instalment of the Welsh scheme, which will expire on June 27, 1902.

The Recent Drought in the North of England.—The number of "Symons's Meteorological Magazine" published last Thursday contains a brief summary of facts relating to the recent great scarcity of water in the North of England. The month of September was unusually dry over all parts of the British Isles, except in Ireland and to the West of Scotland. There the rainfall exceeded the average; elsewhere it was more than 2 inches only in the Lake District, Wales, and on the south coast of England. But in the northern counties generally, both the spring and summer had been drier than usual, and the failure of supply in September made matters serious, though in some places copious falls in the earlier part of the present month have relieved anxiety. The following facts almost speak for themselves: The September rainfall for Derby was 1·11 inches below the average, and that for the nine months 1·63 inches; for Manchester the figures are 0·75 and 6·38 inches; for Skipton, 2·57 and 8·41 inches; for Newcastle, 1·16 and 2·87 inches; for Seathwaite (about the wettest place in Britain), 3·56 and 28·61 inches. These figures signify that the rainfall for the present year has varied in the four last-named places from about 69 to 85 per cent. of the average amount; so last month brought matters into a critical condition. On Sept. 24, Bradford had little more than a week's supply in its reservoirs; Leeds on Sept. 27 had three weeks'; Halifax, only 13 days'; Manchester, notwithstanding its partial supply from Thirlmere, would have exhausted its store in 20 days; and Huddersfield on Oct. 1 had 17 days' supply, with a much reduced service.

Swansea Water Supply.—At last Wednesday's meeting of the Swansea County Council, on the recommendation of the Water Committee, it was resolved that a Bill be promoted in the next session of Parliament to extend the time for the completion of the Cray Water-Works and the period for the repayment of the sum of £100,000 borrowed for the purposes of the works under sanction by the Local Government Board.

Ceara Gas Company, Limited.—In the report prepared by the Directors of this Company for presentation at the annual general meeting of shareholders next Friday, they state that the result of the working in the year ending the 30th of June is a net profit of £2533 16s. 1d., which, added to the balance brought forward, gives a total of £3126 8s. 8d. As no interim dividend was paid in April last, this sum is available for distribution. They express regret that during the year the Company had to pay very heavily for their coals, and in addition were most seriously inconvenienced through the continued inability of the State Government to pay the public lighting accounts when due. A further reduction in the usual profit arose through the destruction of the Company's city offices and stores at Ceará by fire, which practically prevented any fitting business being carried on for some months. After considerable correspondence, the State Government offered bonds for 84,600 milreis (equal, at the average rate of exchange, to £3384 17s. 8d.) in payment of the public lighting accounts for the four months ending Dec. 31, 1900; and this offer the Directors felt themselves obliged to accept. They recommend the declaration of a dividend of 10 per cent. on the preference shares (less income-tax), and of 4 per cent. on the ordinary shares (tax free); making together £2585. These dividends cannot, however, be paid until the necessary funds are received from Ceará. The balance carried forward will be £541.

An Incident in the Water Famine in the North.—As evidence of the high standard of public life in England, nothing has been more encouraging (according to the "Westminster Gazette") than the alertness with which our Provincial Municipalities have come down upon any of their members suspected of breaking that first law of civic life, that public positions shall not be used for the promotion of private interests. "The Manchester case is still fresh in our minds; and there have been a number of minor cases since then illustrating happily the watchfulness with which civic honour is guarded in this matter nowadays. The water famine in the North has provided us with the latest object-lesson of this kind. In the interest of the general public, the supply of water was recently cut off for trade purposes in one of the smaller Yorkshire towns. It now appears that, after this had been done by order of the General Purposes Committee, a special trade supply was continued to the Mayor and three other traders. As a result of the exposure, the Mayor has now resigned his office. Clearly, no other alternative was possible; and we welcome this renewed assertion of the wholesome principle that public life shall not be used to secure private advantages for those who participate in it. These things might have passed in the old days when it was largely taken for granted that a man was a fool to serve the public without getting something out of it. But we have another and a higher standard now; and it must be insistently maintained."

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COLCHESTER	300,000
BIRKENHEAD	2,250,000
SWINDON (New Swindon Gas Co.)	120,000
SALTLEY, BIRMINGHAM (Second Contract)	2,000,000
WINDSOR ST., BIRMINGHAM (Second Contract)	2,000,000
HALIFAX	1,000,000
TORONTO	250,000
OTTAWA	250,000
LINDSAY (Remodelled)	125,000
MONTREAL	500,000
TORONTO (Second Contract; Remodelled)	2,000,000
BELLEVILLE	250,000
OTTAWA (Second Contract)	250,000
BRANTFORD (Remodelled)	200,000
ST. CATHERINES (Remodelled)	250,000
KINGSTON, PA.	125,000
PETERBOROUGH, ONT.	250,000
WILKESBARRE, PA.	750,000
ST. CATHERINES (Second Contract)	250,000
BUFFALO, N.Y.	2,000,000
WINNIPEG, MAN.	500,000
COLCHESTER (Second Contract)	300,000
YORK	750,000
ROCHESTER	500,000
KINGSTON, ONT.	300,000
CRYSTAL PALACE DISTRICT	2,000,000
DULUTH, MINN.	300,000
CATERHAM	150,000
LEICESTER	2,000,000
ENSCHEDE (HOLLAND)	150,000
BUENOS AYRES (RIVER PLATE CO.)	700,000
BURNLEY	1,500,000
KINGSTON-ON-THAMES	1,750,000
ACCRINGTON	500,000
TONBRIDGE	300,000
STRETFORD	500,000
OLDBURY	300,000
TODMORDEN	500,000
SALTLEY, BIRMINGHAM (Third Contract)	2,000,000
YORK (Second Contract)	750,000
ROCHESTER (Second Contract)	500,000
NEWPORT (MON.)	250,000
TOKIO, JAPAN	1,000,000

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Woking District Gas Company.—The eleventh ordinary general meeting of this Company was held at the London Offices on Monday last week—Mr. C. H. Master in the chair. In their report, the Directors stated that the revenue for the year ending the 30th of June was £4793, and the expenditure £4204; leaving a balance of £589 to be carried to the profit and loss account. The sum available for distribution was £758. The Directors decided to transfer £100 from the reserve, and to recommend the payment of a dividend at the rate of 5 per cent., free of income-tax, which would absorb about £800. They expressed pleasure in reporting that the public lighting contract for the ensuing seven years had been secured by the Company, which should lead to a considerable increase in the revenue. In connection with this contract, large extensions of mains had already been made; and it was now found necessary to further enlarge the works—there having been also a substantial increase in the number of consumers since the 30th of June. The report was adopted.

Gas-Fitter Fatally Burned.—Mr. Wynne E. Baxter, the Coroner for East London, held an inquiry on Saturday week, at the London Hospital, concerning the death of Solomon Abin, a gas-fitter, lately residing at Gale Street, Bromley. James Hudson, a fish salesman, of Hackney Road, stated that the previous Friday he engaged deceased to fix a new gas-meter and connect the gas with the living room—the pipes being already there. Witness returned home in the afternoon, and heard that there had been an explosion. He noticed that the ceiling in the passage was all blown down. There was no one in the house when it happened; but several neighours heard the noise, and on going into the house found the deceased sitting on the stairs with his face and hands burned. Allan Cohen stated that the deceased was his brother-in-law. He saw him in the hospital, and was told by him that he was trying the gas with a match when the flame burst out and burnt him. The deceased was a good workman, and understood his business. Dr. Broomhall deposed that the deceased was badly burned, and died from shock. The Jury returned a verdict of "Accidental death."

The London County Council and the South Metropolitan Gas Company.—The *agenda* for the meeting of the London County Council to-day contains the following report from the Public Control Committee in regard to the South Metropolitan Gas Company and their capital: "Sir Robert Giffen, K.C.B., acting as Referee for the Board of Trade, held an inquiry on Sept. 23, 1901, with regard to an application of the South Metropolitan Gas Company for the sanction of the Board to the raising of further capital within their borrowing powers. The Solicitor and Comptroller represented the Council. It transpired at the inquiry that the Company had already raised £176,000 more than had been sanctioned by the Board. The Company's estimate of their capital requirements for the next three years amounted to £833,000; and part of the £1,000,000 authorized by the Company's Act of last session would therefore be needed to supplement the £364,000 balance of the powers under previous Acts. Under the Company's Act of 1900, there is no necessity for an inquiry by the Board of Trade before the capital is raised. The inquiry, therefore, on the present occasion was confined to the necessity of raising the balance of £364,000; and as Parliament had authorized the raising of £1,000,000 within the next five years, it was obvious that the Company's capital expenditure in the next three years must exceed £364,000. At the close of the inquiry, it was understood that the Referee would report in favour of granting the certificate required by the Company, leaving the Board of Trade to deal with the matter of the raising without their sanction of the £176,000."

Eccleshill Gas-Works to be Purchased by Bradford.—Terms have at last been arranged, says the "Bradford Observer," for the transfer of the undertaking of the Eccleshill and Bolton Gas Company to the Bradford Corporation. At a special meeting of the Gas Committee of the Bradford Corporation, it was decided (subject to the approval of the City Council and of Parliament) to accept the offer of the Directors of the Company to sell their undertaking to the Corporation for the lump sum of £56,500, together with £100, being half the estimated cost of winding up—the Company to retain the balance standing to the credit of the revenue account, amounting to £567. The resolution further sets forth that the other details of purchase shall be in accordance with the agreements arranged with the other Gas Companies whose undertakings have been purchased.

The Projected Gas Purchase Scheme at Elland.—According to the "Leeds Mercury," the Elland Urban District Council are considering the question as to whether further steps should be taken in the direction of purchasing the undertaking of the Elland-cum-Greetland Gas Company, which means an expenditure of anything between £130,000 and £200,000. When opposing the Parliamentary Gas Bill, the Council were unable to get the purchase clause inserted; but, after considerable discussion at a private meeting last week, the Council decided to ask the District Councils of Greetland and Stainland to meet the Elland authority at an early date, to ascertain if united action could be taken by the Councils concerned in the direction indicated. It was also decided to ask the Company if they were prepared to part with their undertaking under the Arbitration Clauses Act. These decisions did not receive the unanimous approval of the Council.

At last Tuesday's meeting of the Smethwick Town Council, the Gas Committee recommended, and it was agreed, that the Town Clerk should be instructed to borrow £17,500, at less than 3½ per cent., for the purpose of extensions at the gas-works.

On the occasion of the recent visit of the North of England Gas Managers' Association to Ripon, a photograph was taken of the group in Fountains Abbey. Mr. E. E. J. Anderson, Manager of the Ripon Gas-Works, announces that copies of the photograph can be obtained from him, price 2s. 6d. each.

The Gas Committee of the Walsall Town Council last week reported that they had approved of the sum of £650, part of the expense of opposing the Mond Gas Bill, being charged to the gas-works account. The balance of the cost will be divided between the borough fund and the district fund in equal moieties. The Town Clerk, in reply to an inquiry, said that altogether the cost would be a trifle over £1200.

The Warrington Corporation have ordered a patent "New" scrubber-washer to pass two million cubic feet of gas per diem, from Messrs. W. C. Holmes and Co., of Huddersfield. The same firm have secured contracts to supply and erect a "New" scrubber-washer at Buxton to treat a million cubic feet per diem, and an improved tar extractor of like capacity.

The New Conveyor Company, Limited, of Smethwick, have issued a neat little booklet, to which they have given the title of "Hints," containing illustrations of some of the various kinds of conveying machinery they have erected, mostly at gas-works. The views are faced by a few descriptive lines, and are enclosed in a wrapper. The contents will be found useful to gas managers who are dealing with labour-saving problems.

NOTICES TO CORRESPONDENTS, ADVERTISERS, AND SUBSCRIBERS.

No notice can be taken of anonymous communications. Whatever is intended for insertion must be authenticated by the name and address of the writer; not necessarily for publication, but as a proof of good faith.

COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office NOT LATER than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.

Orders for Alterations in, or Stoppages of, PERMANENT ADVERTISEMENTS should be received by the FIRST POST on SATURDAY.

TERMS OF SUBSCRIPTION to the "JOURNAL."

One Year, 21s.; Half Year, 10s. 6d.; Quarter, 6s. 6d.

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Telegraphic Address: "GASKING, LONDON."
Telephone Number: Holborn 121.

All Communications, Remittances, &c., to be addressed to WALTER KING, 11, BOLT COURT, FLEET STREET, LONDON, E.C.

GAS PURIFICATION AND CHEMICAL COMPANY, LIMITED.

OXIDE OF IRON.

O'NEILL'S Oxide has a larger annual sale than all other Oxides combined. Purity and uniformity of quality guaranteed.

JOHN WM. O'NEILL, Managing Director,
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WINKELMANN'S

"VOLCANIC" FIRE CEMENT.

Resists 4500° Fahr. Best for use in GAS-WORKS.

ANDREW STEPHENSON,
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SPECIAL PAINT FOR GAS-WORKS.

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Telegrams: "ENAMEL." National Telephone 1759.

J. & J. BRADDOCK (Branch of Meters Limited), Globe Meter Works, OLDHAM; and 45 & 47, Westminster Bridge Road, LONDON, S.E.
First-Class Award, Melbourne Exhibition, 1889, for WET AND DRY GAS-METERS, STATION METERS, AND GOVERNORS, PRESSURE-GAUGES, STREET LAMPS AND PILLARS, &c.
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HYDRATED OXIDE OF IRON.

PREPARED from Pure Iron.
Twice as Rich as Bog Ore.
Gives no Back Pressure.
The Cheapest in the Market.
Can be Lent on Hire.
Can be Exchanged for Spent Oxide.
READ HOLLIDAY AND SONS, LTD., HUDDERSFIELD.

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Offices: Commercial Buildings, LEEDS.
Correspondence invited.

PENNY-IN-THE-SLOT WORK.

H. GREENE & SONS, Ltd., are prepared to give QUOTATIONS to Gas Companies or Corporations for FITTING UP COMPLETE and CARRYING OUT the WORK in its entirety, either in Iron or Compo.
19, FARRINGDON ROAD, LONDON, E.C.
Telegrams: "LUMINOSITY."

OXIDE OF IRON OF FINEST QUALITY.

BALE'S Special Fire Cement should be used to keep Retorts, Furnaces, &c., in good repair during the heavy Winter Work.
Send for full Particulars to
BALE & Co., 120 & 121, NEWGATE STREET, LONDON, E.C.
Telegrams: "BOGORE, LONDON."
Telephone "277 HOLBORN."

JOHN RILEY & SONS, Chemical Manufacturers, Hapton, near Accrington, are MAKERS of SULPHURIC ACID, from Brimstone, for Sulphate of Ammonia Making. Highest percentage of Sulphate of Ammonia obtained from the use of this Vitriol. References given to Gas Companies.

GAS TAR wanted.
BROTHERTON AND CO., Tar Distillers.
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PREPAYMENT METER WORK.

CONTRACTS are undertaken by William EDGAR for FITTING UP HOUSES, complete with the PENNY-IN-THE-SLOT INSTALLATIONS. Gas Companies or Corporations indemnified against loss through Accidents, &c. Thousands of Houses have been fitted up by me under this System. Estimates free.
BLENHEIM HOUSE, 23, Lower Mall, HAMMERSMITH.
Telegrams: "GASOSO."
Telephone No. 14 Hammersmith.

SULPHATE OF AMMONIA SATURATORS and LEAD WORK for Sulphate of Ammonia Plants.
For REPAIRS or ALTERATIONS, ring up "0848 BOLTON," or Telegraph "SATURATORS, BOLTON."
Largest Practice and most Up-to-Date Works in Britain.
JOSEPH TAYLOR AND CO., CENTRAL PLUMBING WORKS, BOLTON.

AMMONIACAL LIQUOR wanted. BROTHERTON AND CO., Ammonia Distillers. Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

TO GAS AND WATER OFFICIALS.
HIGH-CLASS CYCLES at Reasonable and LOW PRICES. Guaranteed and sent on approval. For Cash or Gradual Payments. Catalogue post free. Old Machines Exchanged or Repaired.
MELROSE CYCLE COMPANY, COVENTRY.

SULPHURIC ACID for Sale. BROTHERTON AND CO., Chemical Manufacturers. Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

PATENTS FOR INVENTIONS. Messrs. J. C. CHAPMAN & CO., Chartered Patent Agents, ADVISE ON ALL MATTERS CONNECTED WITH ABOVE.
Information and Handbook on application.
70, CHANCERY LANE, LONDON, W.C.

NOTICE is Hereby Given, that the following has been received from an eminent Gas Engineer:—"After inspecting your Patent Hot-Coke Conveyor, I had no hesitation in recommending its adoption at these Works, as no automatic apparatus, in my opinion, could possibly carry away the hot-coke, as drawn from the retorts, with greater freedom from friction and wear.
"With your continuous steel table, carried by the rollers on the rolled trough, I am satisfied I have ordered a strong, simple, and durable design of hot-coke conveyor."
Applications for drawings, specifications, and Tenders for Hot-Coke Conveyors should be addressed to
GILBERT LITTLE, Smethwick.

GAS-TESTING.
MR. T. E. PYE (Eleven Years' Experience in Gas-Works Laboratories) is prepared to visit Gas-Works, and to REPORT to Management on Sulphur Impurities, Illuminating Power, &c., or as to general workings. Tests of Ammoniacal Liquor, Spent Oxide, &c.
No. 372, STANSTEAD ROAD, LEWISHAM.
Drawings Prepared for Works Extensions. Tracings Made.

WANTED, a Situation as Inspector of METERS, STORE-KEEPER, or POST OF TRUST. Twenty Years' Experience in Gas-Works.
Address A. FRY, Gas-Works, BOVEY TRACEY.

ADVERTISER (25 years of age), at present employed as ASSISTANT MANAGER and ASSISTANT to SECRETARY, desires change. Eight Years' Experience in Gas-Works. Excellent Testimonials.
Address No. 3764, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, an Engagement as Engineer and MANAGER, or ASSISTANT ENGINEER and MANAGER, of a Gas-Works. Over Five Years' Experience on Works making nearly 300 million cubic feet per annum, with well-known Engineer.
Address No. 3762, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

SON of a well-known Gas Engineer desires Situation as MANAGER in Gas Company's Show-Room. Thoroughly competent to advise Consumers in Cooking, Heating, and Lighting. Testimonials can be given.
Address No. 3757, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

SON of a well-known Gas and Water Engineer and Manager desires a Situation as FOREMAN, in a Gas-Works. Sixteen Years' practical experience (Seven Years' Foreman). Good Mechanic, having gone through the Fitting-Shop. Well up in Repairs.
Address No. 3765, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, an engagement as Manager or SECRETARY and MANAGER of a Gas or Water-Works. Age 29. Experienced in the construction and working of Modern Gas Plant and Pumping Machinery. Careful and attentive to duties. Excellent Testimonials. No objection to go abroad.
Address No. 3754, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

A GENTLEMAN of considerable experience in the management of Foreign Gas-Works (his last engagement being 17 years Manager and Engineer of Works of 600 millions per annum) is desirous of obtaining the direction of Works abroad of any magnitude. Highest references.
Address, No. 3761, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, an energetic young Man as ASSISTANT in a Gas-Works near London, making about 50 millions. Must be competent to assist in keeping Accounts, and the preparation of Drawings. Salary £70 per annum.
Apply, with Testimonials and Specimen of Drawings, stating Age, to No. 3759, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, a good General Fitter. One able to do a little Smithy work preferred. Wages 30s. per week.
Apply, with References, to the MANAGER, Gas-Works, Ascot, BERKS.

WANTED, a Man to set Retorts and do general Bricklaying at Works near Birmingham. Must be used to Regenerative Settings. Permanent Situation to suitable Man.
State Age, Experience, Wages required, &c., to No. 3753, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, Set of Two or Four Second-hand PURIFIERS. Minimum Size, 12 ft. by 12 ft. by 5 ft.; Maximum, 16 ft. by 16 ft. by 5 ft.
Send Price and full Particulars to No. 3763, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

GAS PLANT for Sale—I can always offer NEW and SECOND-HAND GAS APPARATUS, including Retorts and Fittings, Condensers, Exhausters, Scrubbers, Washers, Purifiers, Gasholders, Tanks, Valves, Connections, &c. Also a few COMPLETE WORKS. Compare Prices and Particulars before ordering elsewhere.
J. F. BLAKELEY Gas Engineer, Thornhill, DEWSBURY.

TO BE SOLD—
GASHOLDER (and Cast-Iron Tank), 20,000 cubic feet capacity.
CENTRE-VALVE, 15 in. diameter, by Walker, for Four Purifiers.
Four PURIFIERS, 10 feet square, in line, with Planed Joints, Walker Centre-Valve, Covers, and Traversing Crab Lifting Gear. Will be refixed equal to new.
Write J. WRIGHT, Bridge House, BLACKFRIARS, E.C.

THE Foreign Patent Rights of Simmance and Abady's PATENT FLASH-TORCH for Incandescent Street Lighting are FOR SALE. Patents have been granted in France, Belgium, Germany, Austria, Hungary, Italy, Canada, and the United States of America.
For Particulars, apply to JACQUES ABADY, care of Alex. Wright and Co., Limited, 81, Page Street, LONDON, S.W.

BOROUGH OF HERTFORD.
THE Corporation of Hertford invite TENDERS for the supply and fixing of about 200 COPPER FRAME STREET LANTERNS and KERN BURNERS.
Pattern of Lantern can be seen, and other Particulars and Form of Tender obtained, at the Borough Surveyor's Office.
Tenders, endorsed "Street Lighting," to be sent to the undersigned on or before the 5th of November, 1901.
The Corporation will not be bound to accept the lowest or any Tender.
T. J. SWORDER,
Town Clerk.
Hertford, Oct. 17, 1901.

COUNTY BOROUGH OF SALFORD.
(GAS DEPARTMENT.)
THE Gas Committee invite Tenders for the purchase of about 1000 Tons of SPENT OXIDE.
Further Particulars and Form of Tender may be obtained from Mr. W. Woodward, Engineer, Gas Offices, Bloom Street, Salford.
Sealed Tenders, endorsed "Tender for Spent Oxide," addressed to the Chairman of the Gas Committee, Town Hall, Salford, to be sent to me not later than Three p.m., on Thursday, the 31st of October, 1901.
L. C. EVANS,
Town Clerk.
Town Hall, Salford,
Oct. 21, 1901.

MANCHESTER CORPORATION GAS-WORKS.
TO OIL IMPORTERS AND OTHERS.
THE Gas Committee of the Corporation of Manchester are prepared to receive TENDERS for the supply of OIL for the manufacture of Carburetted Water Gas. The Oil to have a flashing-point of not less than 73 degrees (Abel's test) and not less than any higher degree of temperature which may be specified in any future Act of Parliament or Regulations to be made thereunder.
Full description, with analysis of the Oil offered, must be submitted with each Tender, as well as a sealed sample of the same. The quantity of Oil to be delivered, free of all charges (including Ship Canal dues), into the Storage Tanks of the Corporation, at Trafford Wharf, on the banks of the Manchester Ship Canal, in such quantities as may be from time to time required by the Gas Committee, will be 6000 tons during the six months ending the 30th of September, 1902, or alternatively 12,000 tons during the twelve months ending the 31st of March, 1903. Tenders to be at a price per imperial gallon.
Further Particulars may be obtained on application (in writing only) to Mr. Charles Nickson, Superintendent of the Gas Department.
Sealed Tenders and Samples, addressed to the Chairman of the Gas Committee, and endorsed "Tender for Gas Oil," must be delivered at the Office of the Superintendent of the Gas Department, Town Hall, Manchester, on or before Wednesday, the 20th day of November, 1901.
The Corporation do not bind themselves to accept the lowest or any Tender.
By order of the Gas Committee,
WM. HENRY TALBOT,
Town Clerk.
Town Hall, Manchester,
Oct. 18, 1901.

SALES BY AUCTION OF GAS AND WATER STOCKS AND SHARES.
MR. ALFRED RICHARDS begs to notify that his AUCTIONS of STOCKS and SHARES in London, Suburban, and Provincial Gas and Water Companies are held PERIODICALLY, at the Mart, Tokenhouse Yard, E.C.
He also undertakes the issuing by AUCTION of GAS and WATER STOCKS and SHARES under Parliamentary Powers.
Terms for issuing such Capital, and also for including Gas and Water Stocks and Shares in these periodical Sales, can be obtained on application at Mr. ALFRED RICHARDS' OFFICES, 18, FINSBURY CIRCUS, E.C.

By order of the Directors of the
REDHILL GAS COMPANY.
£5000 ORDINARY "B" STOCK.
MR. ALFRED RICHARDS will Sell the ABOVE BY AUCTION, at the Mart, E.C., on Monday, Oct. 28, at Two o'clock, in Lots.
Particulars of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

By order of the Executors of the late Mr. George Cuthbert, Senr.
GAS STOCKS AND SHARES
IN THE
TOTTENHAM AND EDMONTON GASLIGHT AND COKE COMPANY; COLNEY HATCH GAS COMPANY; WALTHAM ABBEY AND CHESHUNT GAS AND COKE COMPANY; AND WORTHING GAS COMPANY.
MR. ALFRED RICHARDS will Sell the ABOVE BY AUCTION, at the Mart, Tokenhouse Yard, E.C., on Monday, Oct. 28, at Two o'clock precisely, in Lots.
Particulars of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

By order of the Directors of the
ALLIANCE AND DUBLIN CONSUMERS' GAS COMPANY.
NEW ISSUE OF 2000 £10 ORDINARY SHARES,
Ranking for a Standard Dividend of 7 per cent., subject to the Sliding-Scale; the Dividends on similar Shares in the Company having since 1884 been regularly paid at the rate of 7½ per cent. per annum.
MR. ALFRED RICHARDS will Sell the ABOVE BY AUCTION, at the Mart, Tokenhouse Yard, London, E.C., on Monday, Oct. 28, at Two o'clock precisely, in Lots.
Particulars may be obtained at the HEAD OFFICES OF THE COMPANY in D'Olier Street, DUBLIN, and of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

By order of the Directors of the
HARROW AND STANMORE GAS COMPANY.
NEW ISSUE OF 300 £10 "C" SHARES.
MR. ALFRED RICHARDS will Sell the ABOVE BY AUCTION, at the Mart, E.C., on Monday, Nov. 11, at Two o'clock precisely, in Lots.
Particulars of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

By order of the Directors of the
ILFORD GAS COMPANY.
£5000 ORDINARY "C" STOCK, and
£5000 FOUR PER CENT. PERPETUAL DEBENTURE STOCK.
MR. ALFRED RICHARDS will Sell the ABOVE BY AUCTION, at the Mart, E.C., on Monday, Nov. 11, at Two o'clock, in Lots.
Particulars of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

By order of the Directors of the
GRAYS GAS COMPANY, LIMITED.
NEW ISSUE OF 250 £10 "B" SHARES.
MR. ALFRED RICHARDS will Sell the ABOVE BY AUCTION, at the Mart, E.C., on Monday, Nov. 11, at Two o'clock, in Lots.
Particulars of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

By order of the Directors of the
SOUTH ESSEX WATER-WORKS COMPANY.
NEW ISSUE OF £5000 ORDINARY STOCK.
MR. ALFRED RICHARDS will Sell the ABOVE BY AUCTION, at the Mart, E.C., on Monday, Nov. 11, at Two o'clock precisely, in Lots.
Particulars of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

CHESTER UNITED GAS COMPANY.
THE Directors of the Chester United Gas Company give Notice that
£10,000 ORDINARY STOCK
OF AND IN THE
CHESTER UNITED GAS COMPANY,
bearing a Maximum Dividend of £5 per cent., under the powers of the Chester Gas Act, 1901, will be OFFERED FOR SALE BY AUCTION by
Messrs. BRANCH & LEETE,
on Thursday, the 24th of October, 1901, at Three o'clock in the Afternoon precisely, at the Law Association Rooms, Cook Street, Liverpool, subject to the Conditions of Sale, which will be then produced.
The Stock will be offered in Lots of the nominal amount of £100 each, and will be issued to each purchaser as paid-up Stock after the full payment of the Purchase Money.
For further Particulars, apply to Mr. JAMES PYE, Gas Offices, Cuppin Street, CHESTER; or the Auctioneers, Messrs. BRANCH AND LEETE, Hanover Street, LIVERPOOL.

ROCHESTER, CHATHAM, AND STROOD GASLIGHT COMPANY.

RETORTS, &c.

THE Directors invite Tenders for the supply of FIRE-CLAY RETORTS, FIRE-BRICKS, and CLAY.

Specifications and Form of Tender may be obtained from the undersigned, to whom Tenders, endorsed "Retorts, &c.," must be delivered on or before noon of Monday, Oct. 28, 1901.

J. M. VEEVERS,
Engineer and General Manager.

Gas Offices, Rochester,
Oct. 17, 1901.

CEARA GAS COMPANY, LIMITED.

NOTICE is Hereby Given, that the ORDINARY ANNUAL GENERAL MEETING of the Shareholders will be held at the Offices of the Company, 9, Queen Street Place, Cannon Street, in the City of London, on Friday, the 25th day of October, 1901, at 12.30 o'clock in the afternoon, to receive the Report of the Directors, to declare a Dividend, to elect Directors and an Auditor, and for General Purposes.

The TRANSFER BOOKS will be closed from the 12th to the 25th of October, both days inclusive.

By order of the Board,
GEORGE R. GUYATT,
Secretary.

Oct. 11, 1901.

TO INVESTORS AND CAPITALISTS.

MESSRS. PENDERED & SONS are Instructed to OFFER FOR SALE by PUBLIC AUCTION, in Lots, at the Hind Hotel, Wellingborough, on Wednesday, Oct. 30, 1901, at Five for Six o'clock in the Evening,

600 £10 SHARES in the WELLINGBOROUGH GASLIGHT COMPANY, LIMITED.

The Shares will bear Dividend as from the 1st of January, 1902.

The Dividend paid for the last Three Years on the £10 Shares of the Company has been at the rate of £9 per centum per annum, free from Income-Tax. As the business of the Company is steadily increasing, and there is an ample Reserve Fund, it may be confidently expected that this Dividend will be maintained in the future.

There are no Founders or Preference Shares in the Company; and all the Shares rank for Dividend according to their relative nominal value.

Further Particulars may be obtained of the AUCTIONEERS, WELLINGBOROUGH; Mr. S. H. KIMBELL, the Gas Company's Office, Commercial Place, WELLINGBOROUGH; or of Messrs. SHARMAN JACKSON AND ARCHER, Solicitors, West End House, WELLINGBOROUGH.

WISBECH WATER-WORKS COMPANY.

DESIRABLE INVESTMENT.

TO be Sold by Auction, by Mr. Joseph JOHNSON, at the Public Hall, Wisbech, on Thursday, the 24th day of October, 1901, at Three o'clock precisely, subject to such Conditions as will be then produced, and in Lots intended to suit the convenience of Purchasers,

800 NEW ORDINARY SHARES
Of the Nominal Value of £10 each in the
WISBECH WATER-WORKS COMPANY.

The above Shares will be issued and sold under the authority of the Wisbech Water Order, 1884, which limits the Annual Dividend payable by the Company upon Shares issued under the said Order to 7 per Cent.

A payment of 20 per Cent. of the Purchase Money will be required at the time of sale, 20 per Cent. on the 25th day of January, 1902; 20 per Cent. on the 26th day of April, 1902; 15 per Cent. on the 28th day of July, 1902; 20 per Cent. on the 24th day of December, 1902; and the balance (5 per Cent.) on the 30th day of June, 1903.

Purchasers will be entitled to Interest calculated on the respective amounts of their paid-up calls (except the first) after the rate of £5 per Cent. per annum out of the Profits of the Half Years ending the 30th day of June, 1902, the 31st day of December, 1902, the 30th day of June, 1903, and subsequently to the Half-Yearly Dividends of the Company, which will from time to time become due upon their respective Shares.

Any Purchaser wishing to pay the whole of his Purchase Money at once, or to accelerate the payment of his calls, may arrange to do so on application to the Clerk.

By order,
ROBT. DAWBARN,
Clerk to the Company.

ROBERT MARSHALL,
CANNEL COAL MERCHANT,
97, WELLINGTON STREET, GLASGOW.

Prices and Analysis of all the Scotch Cannels on Application.

HEATHCOTE GAS COAL.

Rich in Illuminating Power and Yield of Gas. Above the Average in Weight and Quality of Coke.

Maintains a High Standard in Residuals.

THE GRASSMOOR CO., LD.,
CHESTERFIELD.

"The standard work on the subject."—*Gas World.*

Now Ready. Price 35s., for Cash post free 28s. 8d.

MICHAEL & WILL ON THE LAW RELATING TO

GAS & WATER.

FIFTH EDITION. By
J. SHIRESS WILL, K.C.

BUTTERWORTH & CO., Law Publishers, 12, Bell Yard, Temple Bar, W.C.

HYDRAULIC BLOWER

For blowing Air into Gas Purifiers for the purpose of

REVIVIFYING THE FOULED OXIDE.

Full Particulars on application.

LUXWERKE LUDWIGSHAFEN AM RHEIN.

JAMES OAKES & CO.

ALFRETON IRON-WORKS, DERBYSHIRE,
AND
Wenlock Iron Wharf, 21 & 22, Wharf Road, CITY ROAD, LONDON, N.,

Manufacture and keep in Stock at their Works (also large stock in London)

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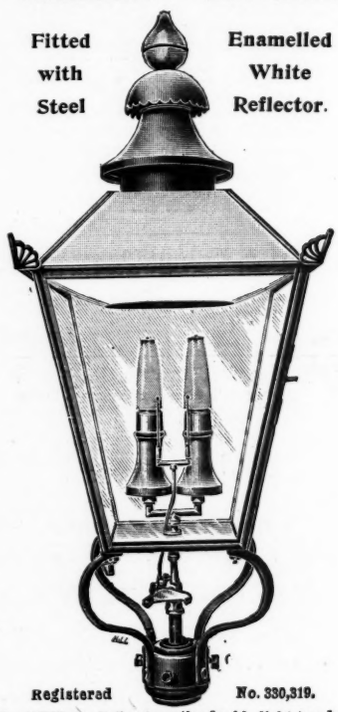

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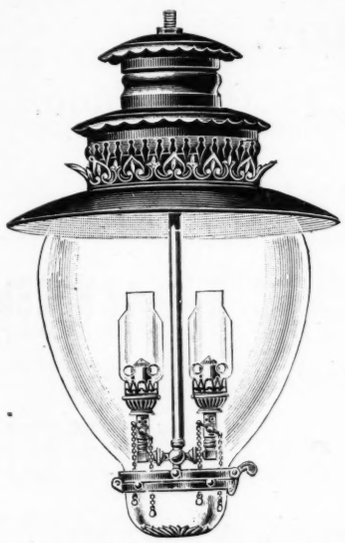

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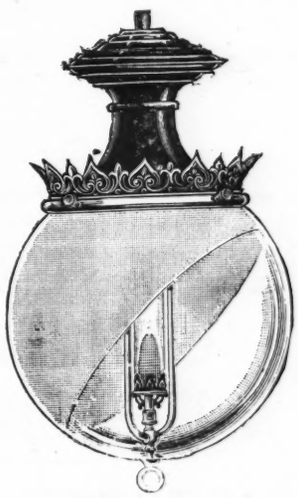

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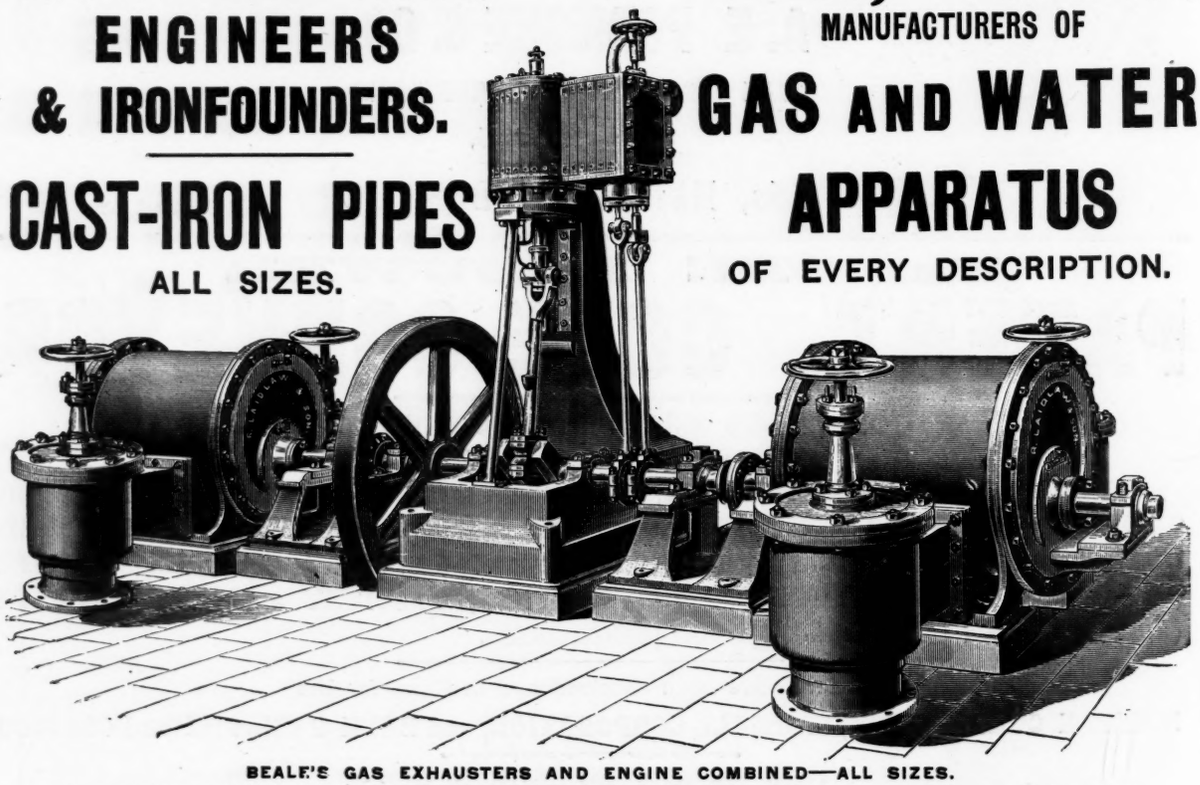

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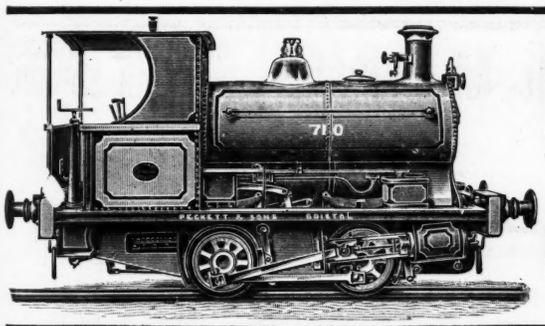

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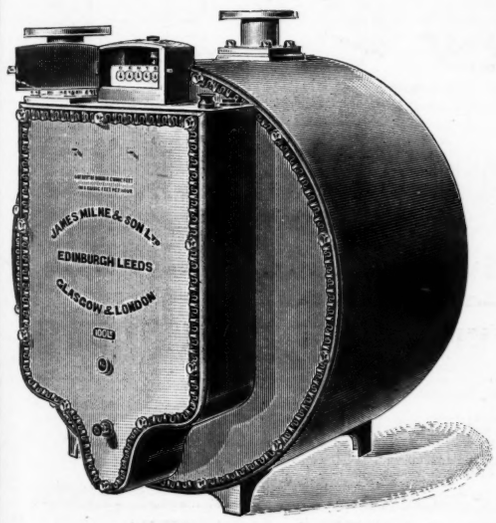

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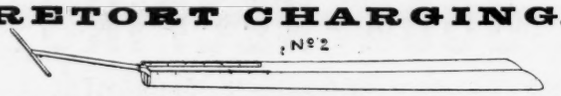
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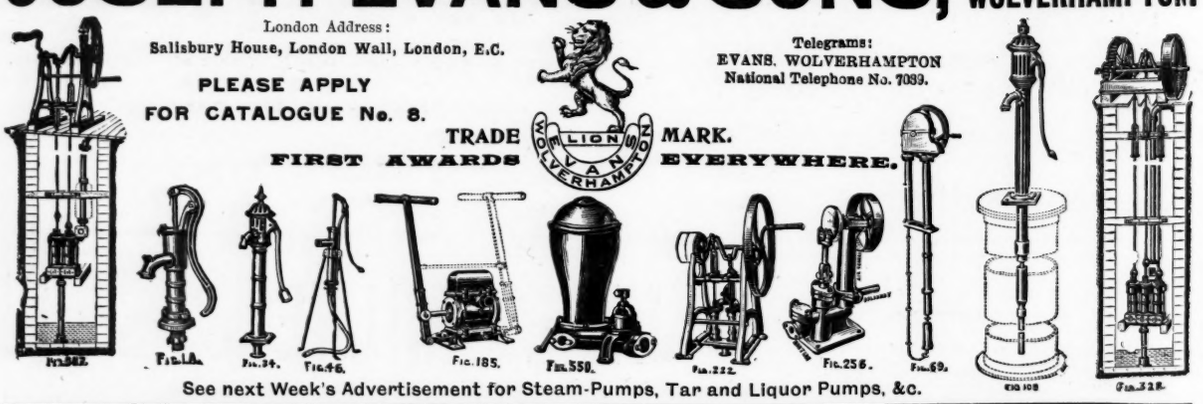

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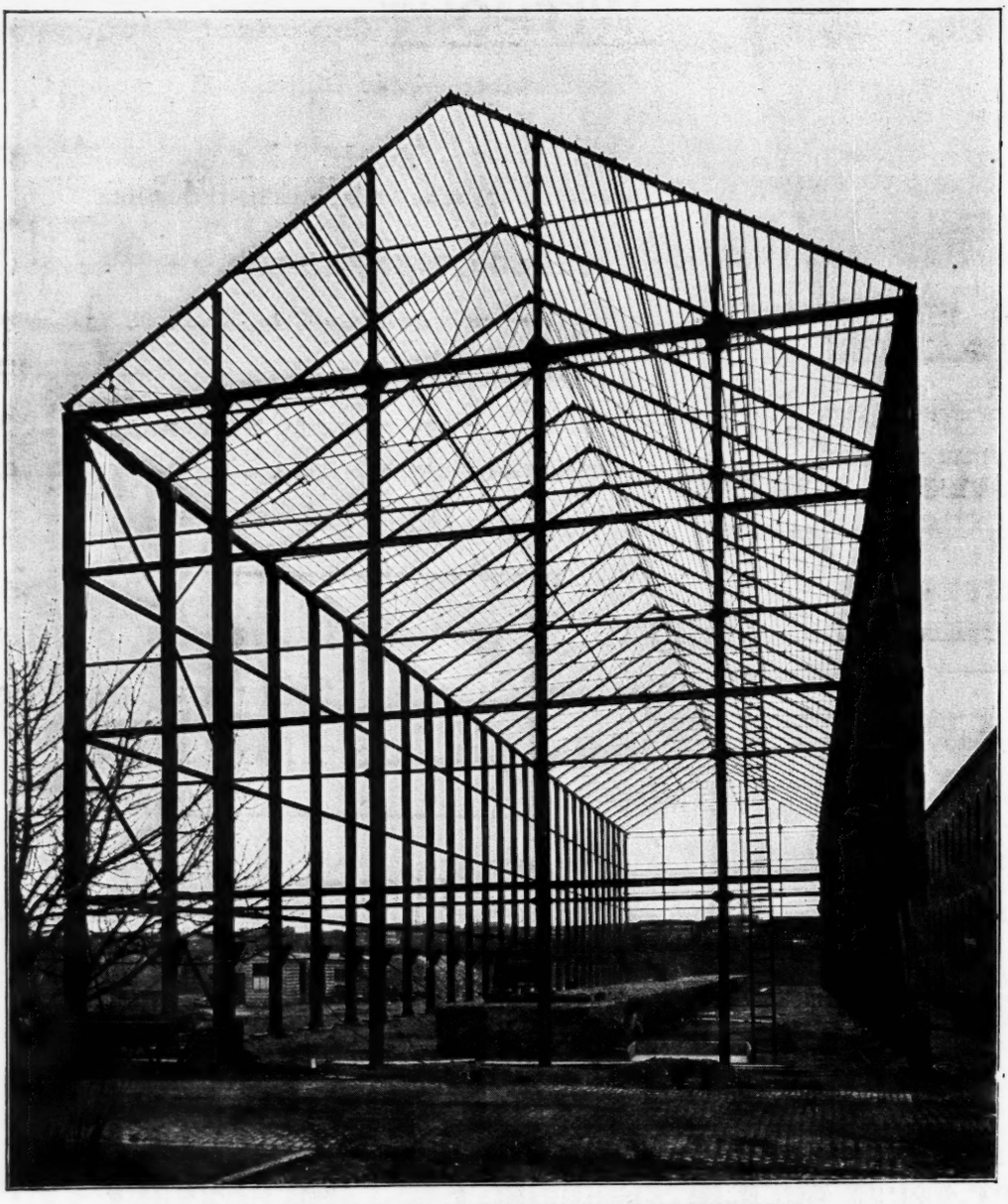

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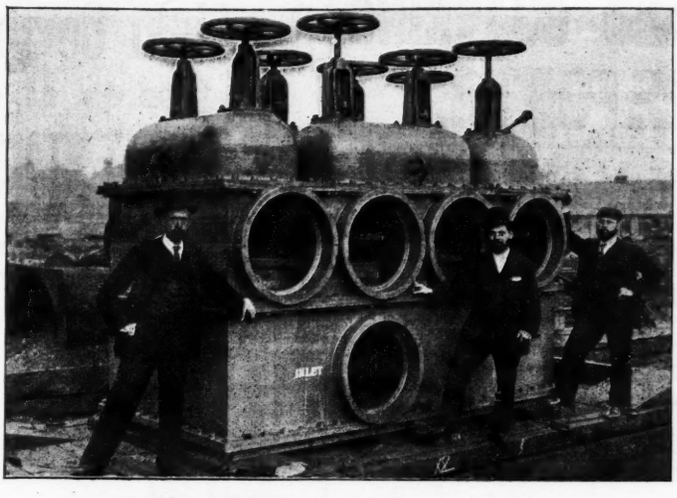

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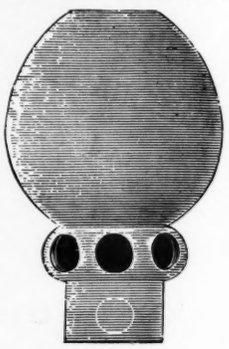

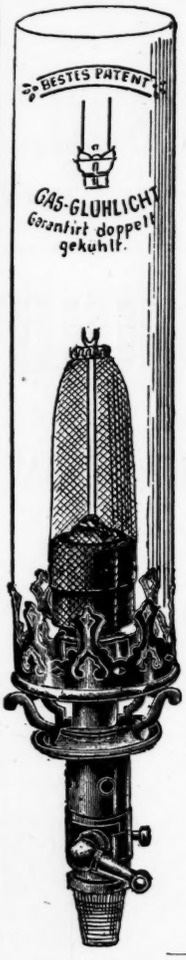

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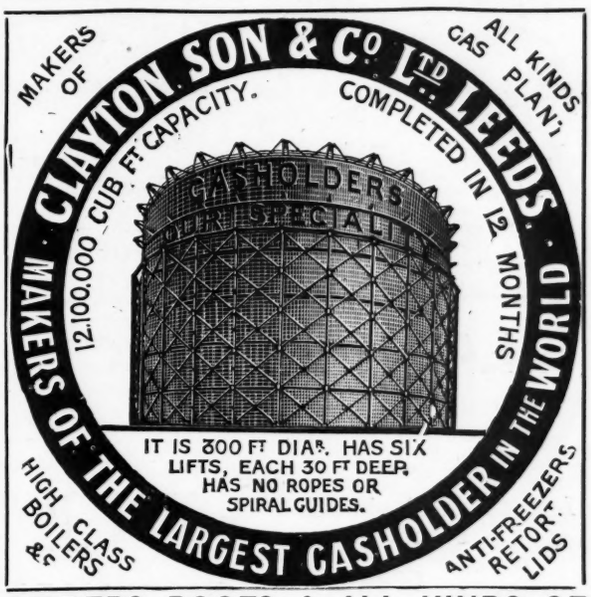
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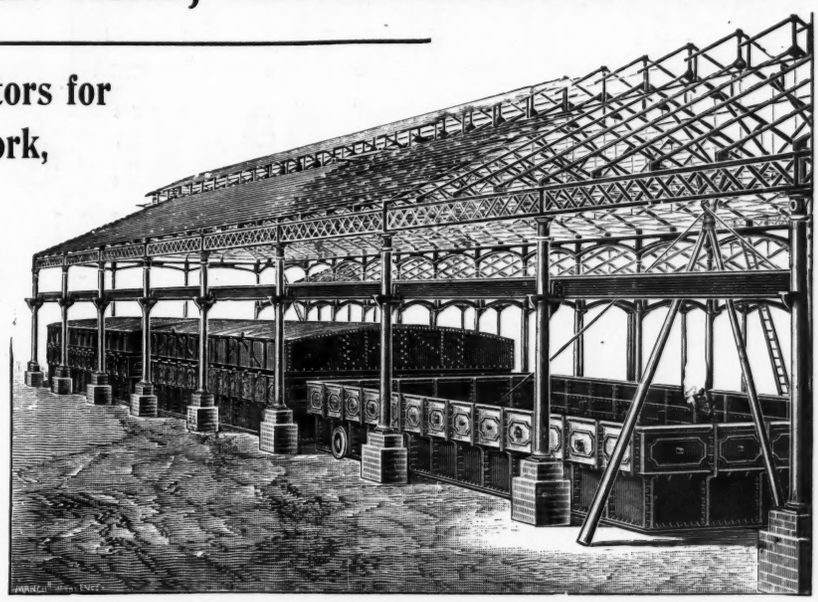

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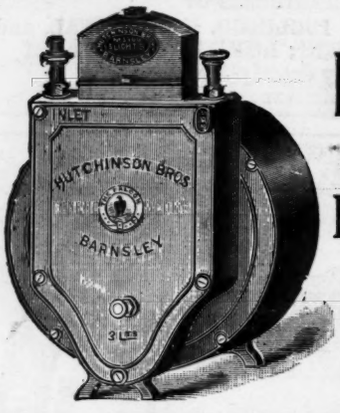

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